US009463833B2

(12) **United States Patent**
Smith et al.

(10) **Patent No.: US 9,463,833 B2**
(45) **Date of Patent: *Oct. 11, 2016**

(54) **ALIGNMENT RESTORATION DEVICE FOR LOAD TRANSPORTING APPARATUS**

(71) Applicant: **Entro Industries, Inc.**, Hillsboro, OR (US)

(72) Inventors: **Shawn R. Smith**, Hillsboro, OR (US); **Harlan B. Smith**, Beaverton, OR (US)

(73) Assignee: **ENTRO INDUSTRIES, INC.**, Hillsboro, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **15/094,664**

(22) Filed: **Apr. 8, 2016**

(65) **Prior Publication Data**

US 2016/0221620 A1 Aug. 4, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/529,566, filed on Oct. 31, 2014, which is a continuation-in-part of application No. 13/909,969, filed on Jun. 4, 2013, now Pat. No. 9,096,282, which is a continuation-in-part of application No.

(Continued)

(51) **Int. Cl.**
B62D 51/06 (2006.01)
B62D 57/02 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC ***B62D 57/02*** (2013.01); ***B62D 57/032*** (2013.01); ***E21B 15/003*** (2013.01); ***E21B 15/006*** (2013.01)

(58) **Field of Classification Search**
CPC B62D 57/00; B62D 57/02; B62D 57/022; B62D 57/032
USPC 180/8.1, 8.5, 8.6
See application file for complete search history.

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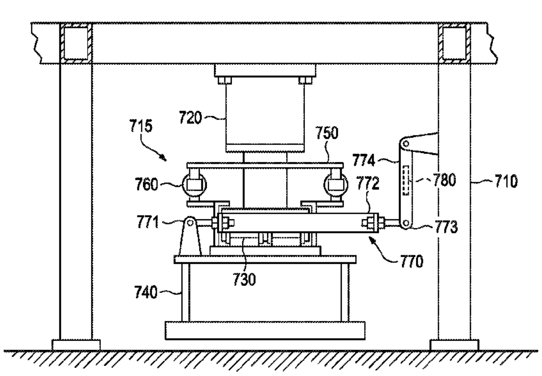
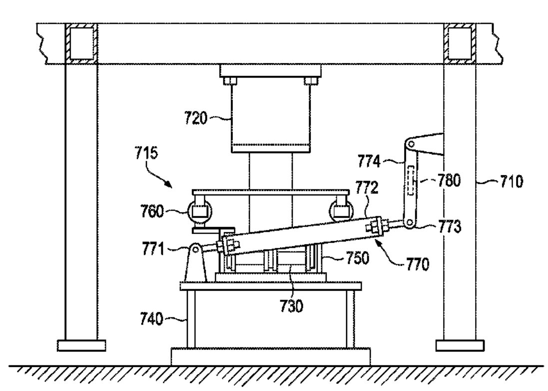
Primary Examiner — Joseph Rocca
Assistant Examiner — Conan Duda
(74) *Attorney, Agent, or Firm* — Schwabe, Williamson & Wyatt

(57) **ABSTRACT**

Embodiments of the present invention are directed to a load transporting apparatus that automatically aligns a support foot of the apparatus with a load-bearing frame connected to the load transporting apparatus during a recovery phase of an incremental walking movement. In particular, the load transporting apparatus includes a linking device attached to a support foot of the apparatus and a biasing device connected to the linking device that is deflected during non-linear load transporting movements, where the biasing device acts to automatically return the support foot to an aligned position relative to the load-bearing frame after a non-linear movement has been completed and the support foot is raised above a ground surface.

29 Claims, 29 Drawing Sheets





Related U.S. Application Data

13/711,193, filed on Dec. 11, 2012, now Pat. No. 8,573,334, and a continuation-in-part of application No. 13/711,269, filed on Dec. 11, 2012, now Pat. No. 8,561,733, and a continuation-in-part of application No. 13/711,315, filed on Dec. 11, 2012, now Pat. No. 8,490,724.

(60) Provisional application No. 61/757,517, filed on Jan. 28, 2013, provisional application No. 61/576,657, filed on Dec. 16, 2011.

(51) **Int. Cl.**
E21B 15/00 (2006.01)
B62D 57/032 (2006.01)

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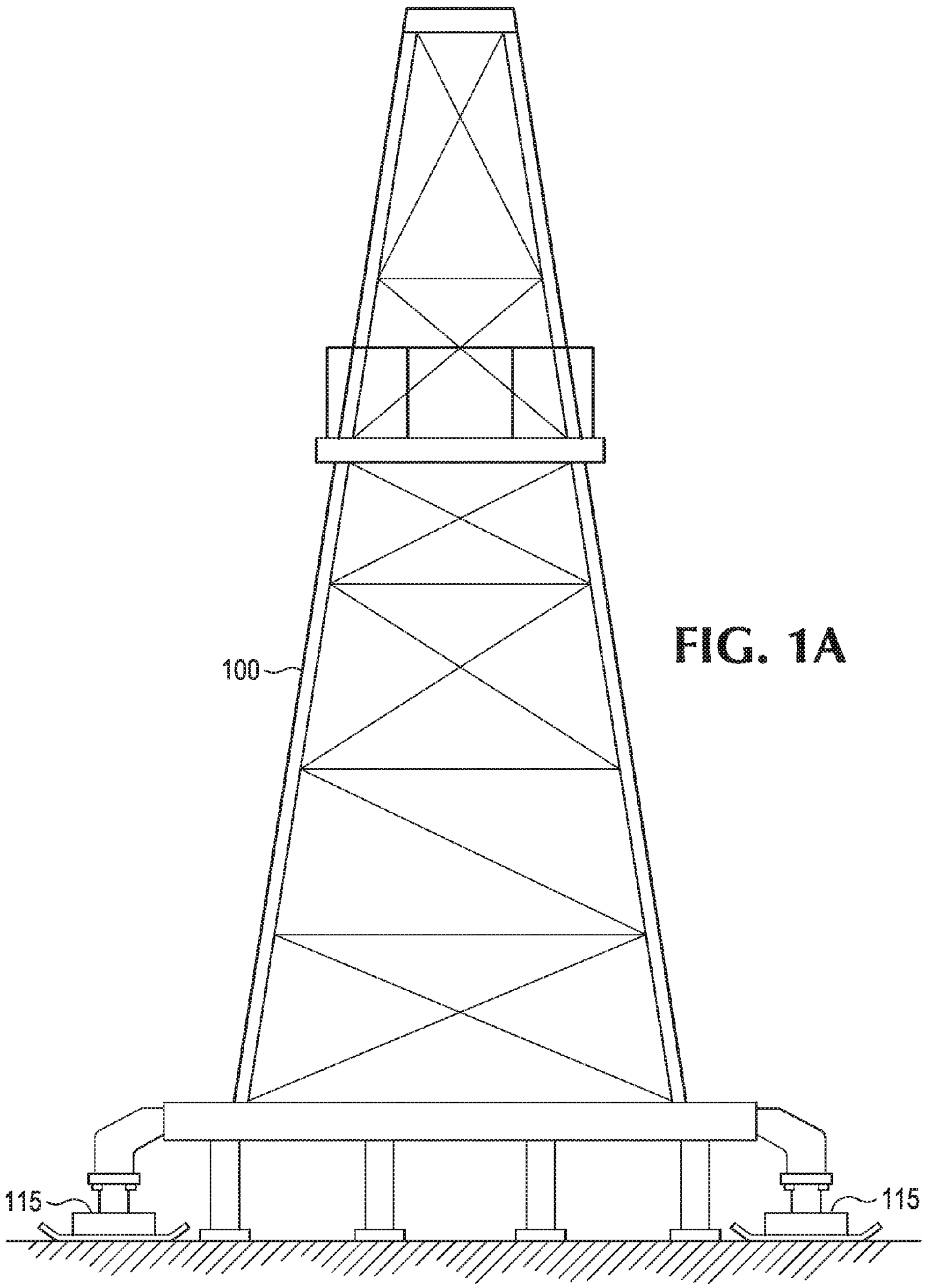


FIG. 1A

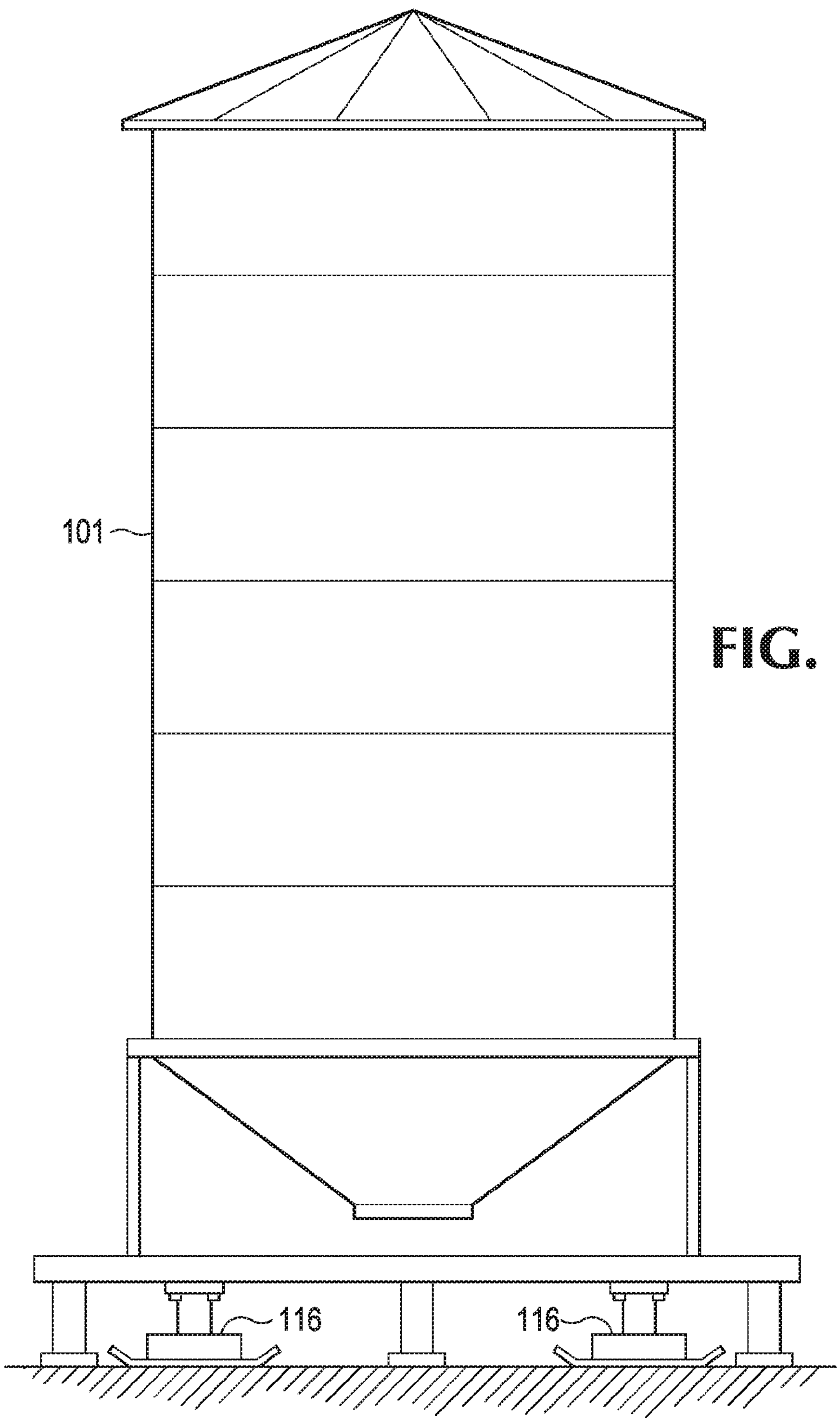


FIG. 1B

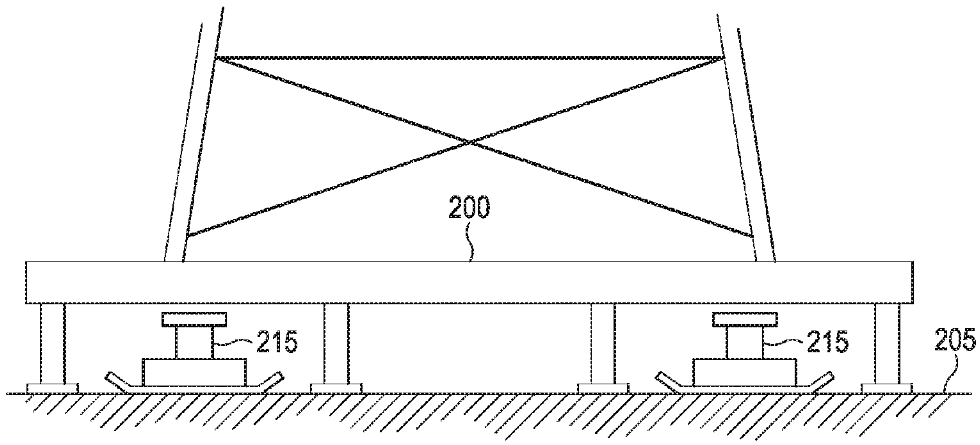


FIG. 2A

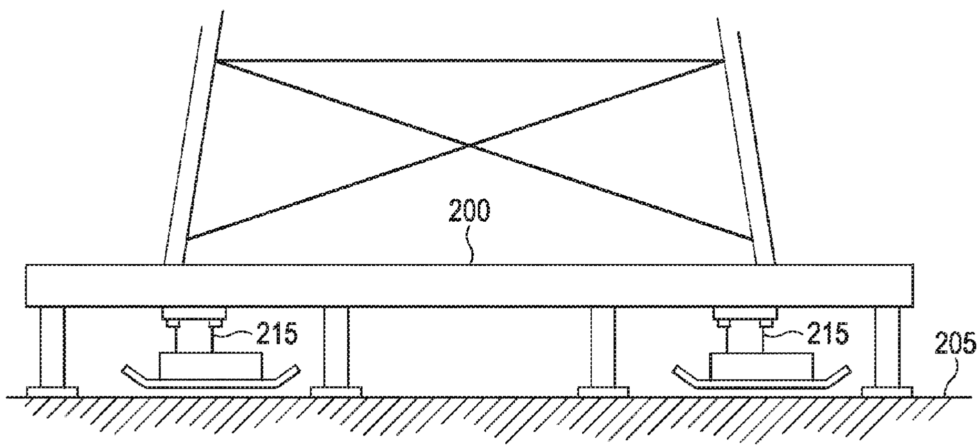


FIG. 2B

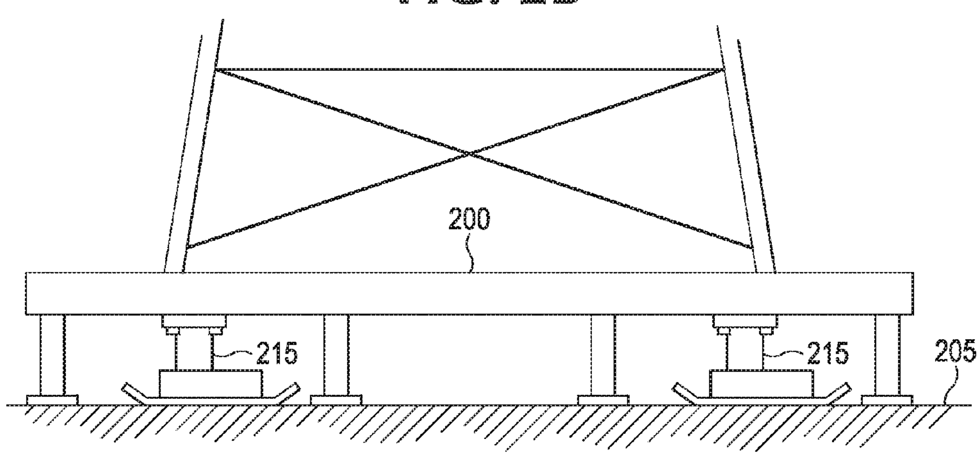


FIG. 2C

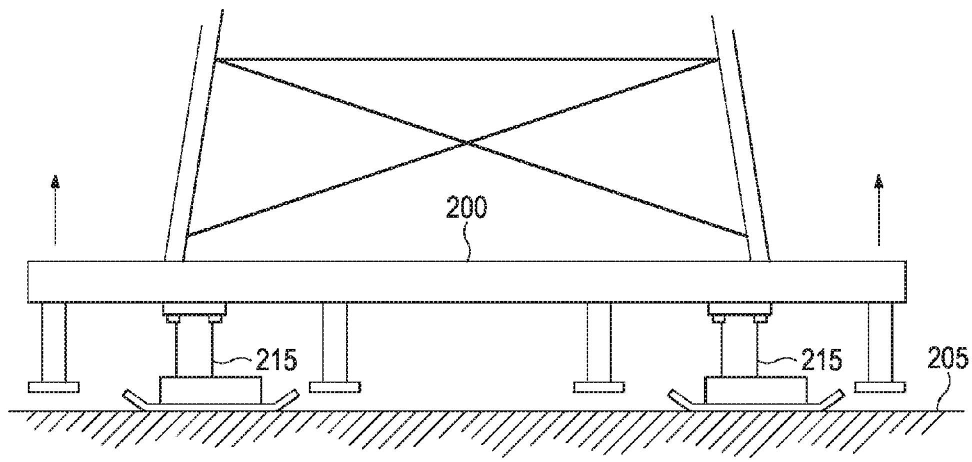


FIG. 2D

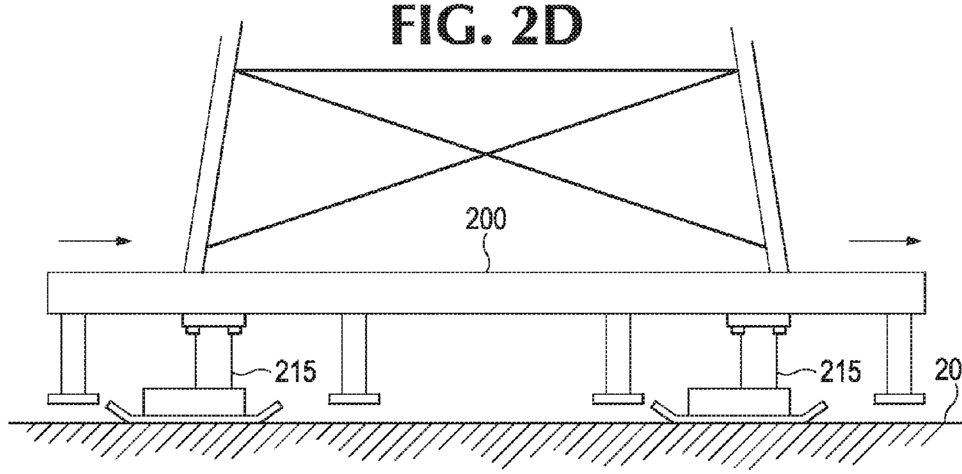


FIG. 2E

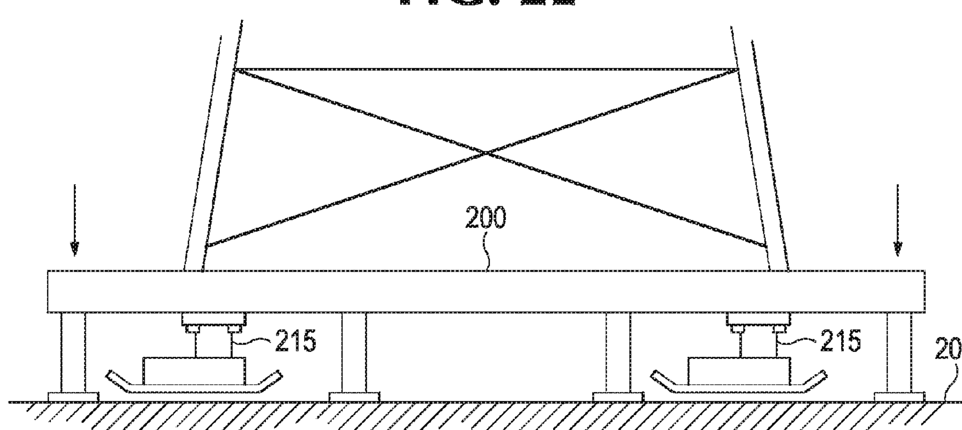


FIG. 2F

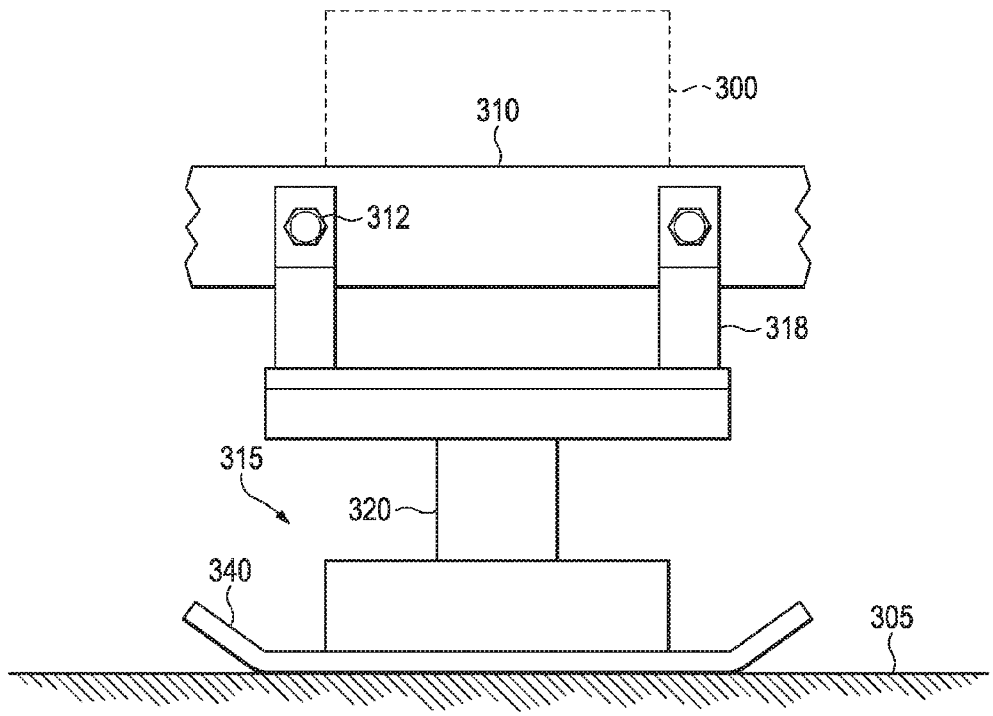


FIG. 3A

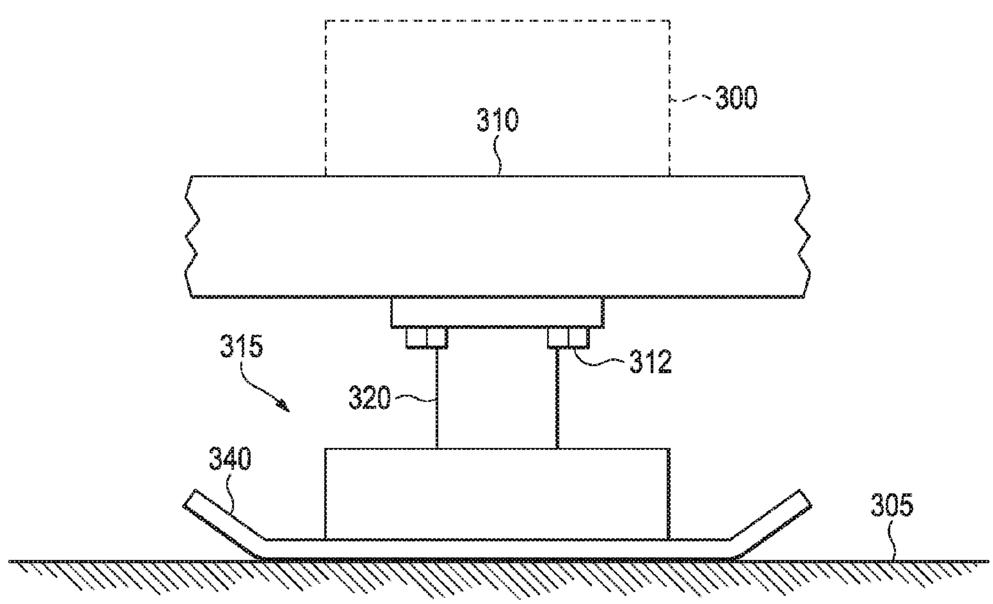
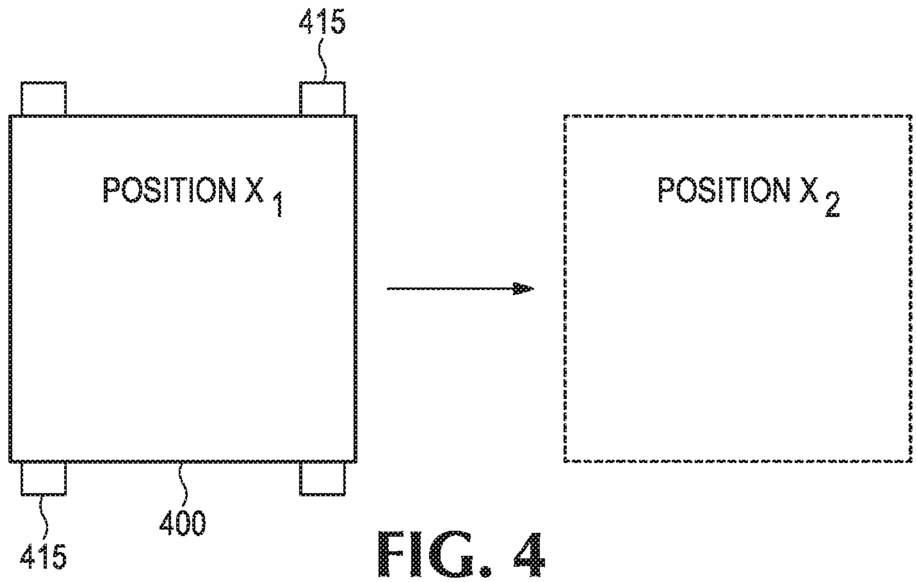


FIG. 3B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POSITION X_2
415
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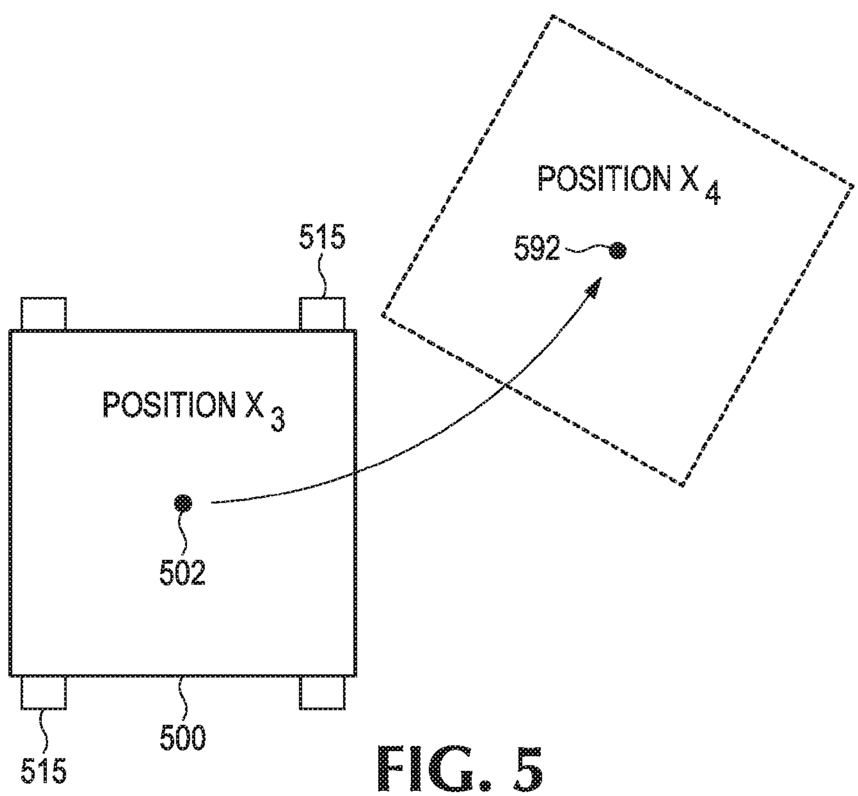
FIG. 4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POSITION X_3
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FIG. 5

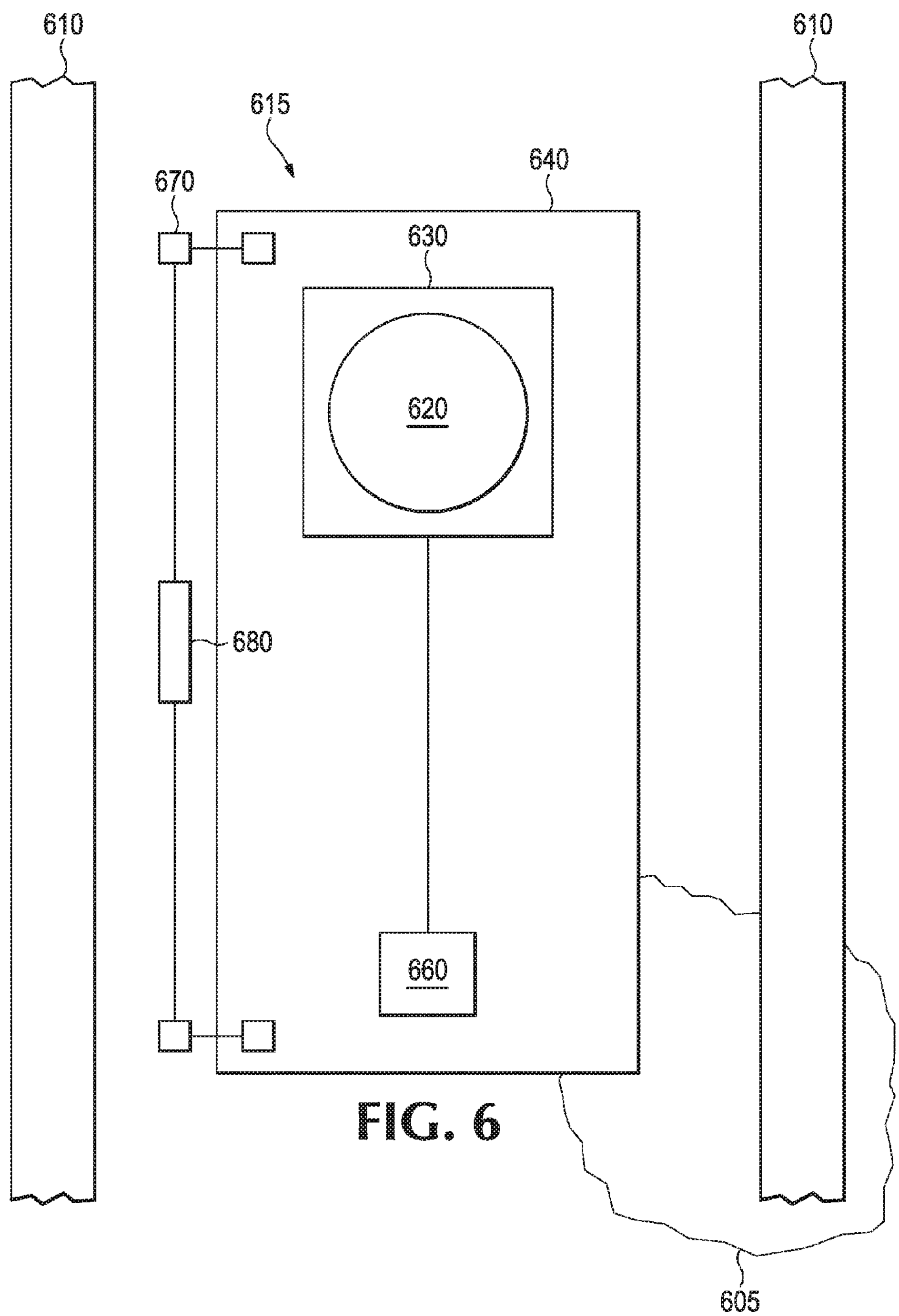

FIG. 6

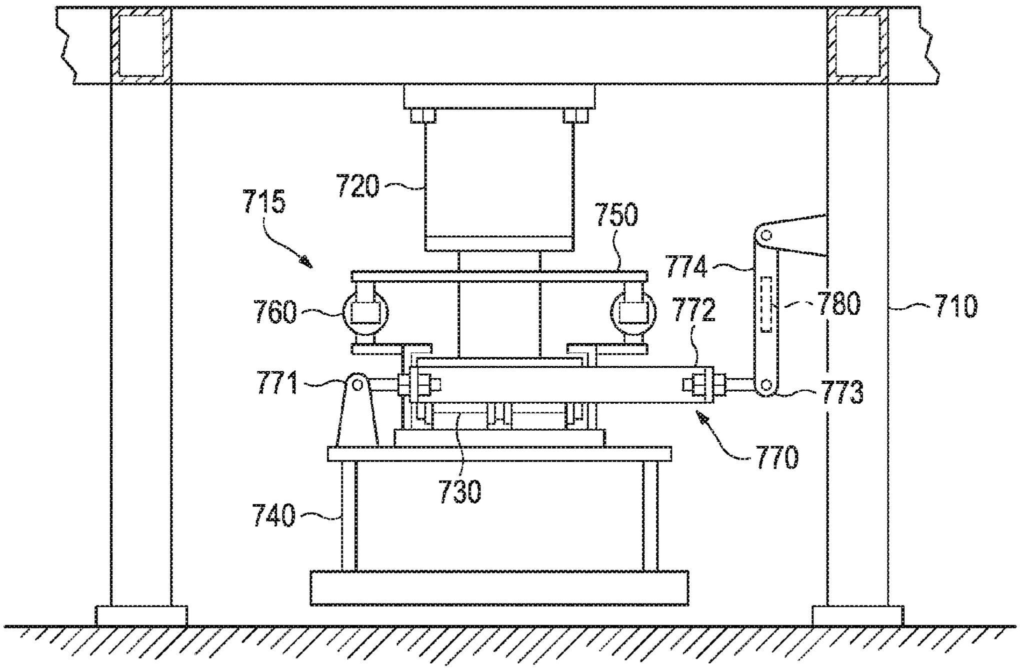
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FIG. 7A

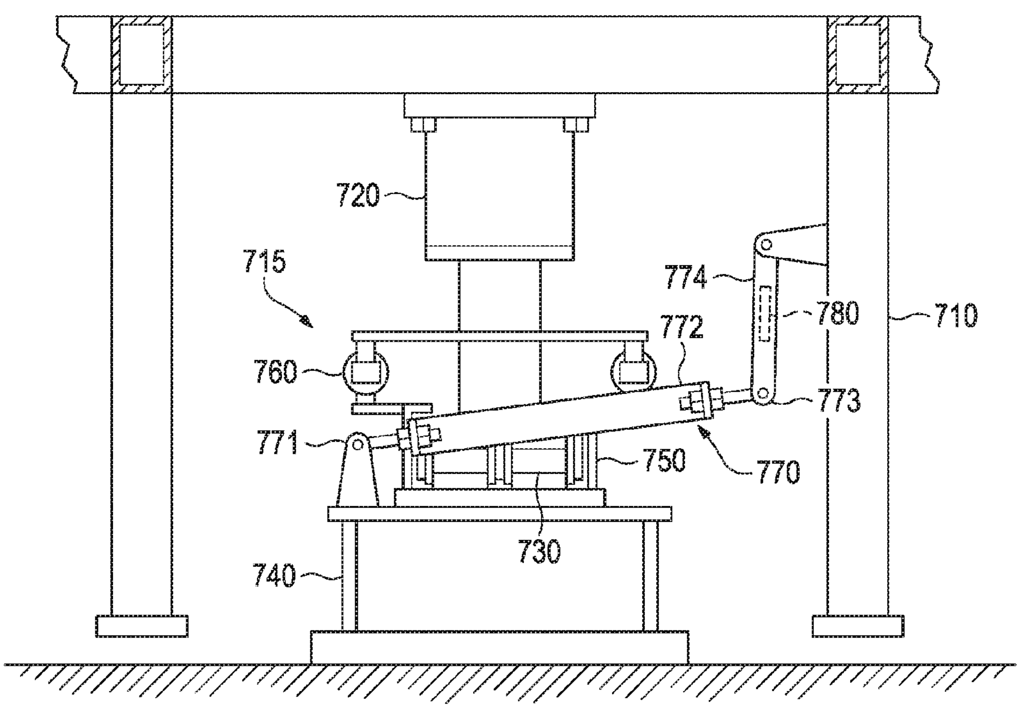
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FIG. 7B

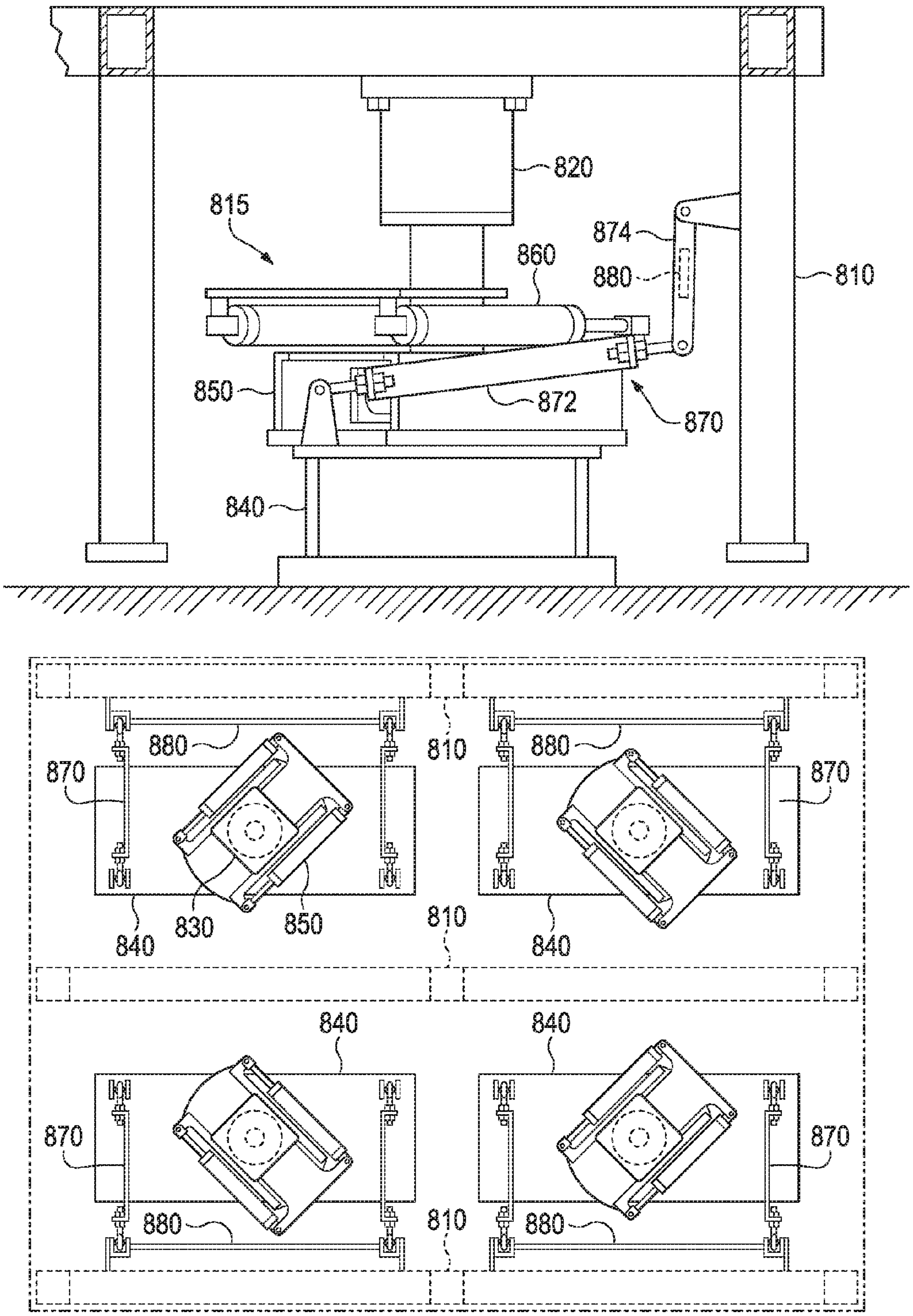
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FIG. 8A

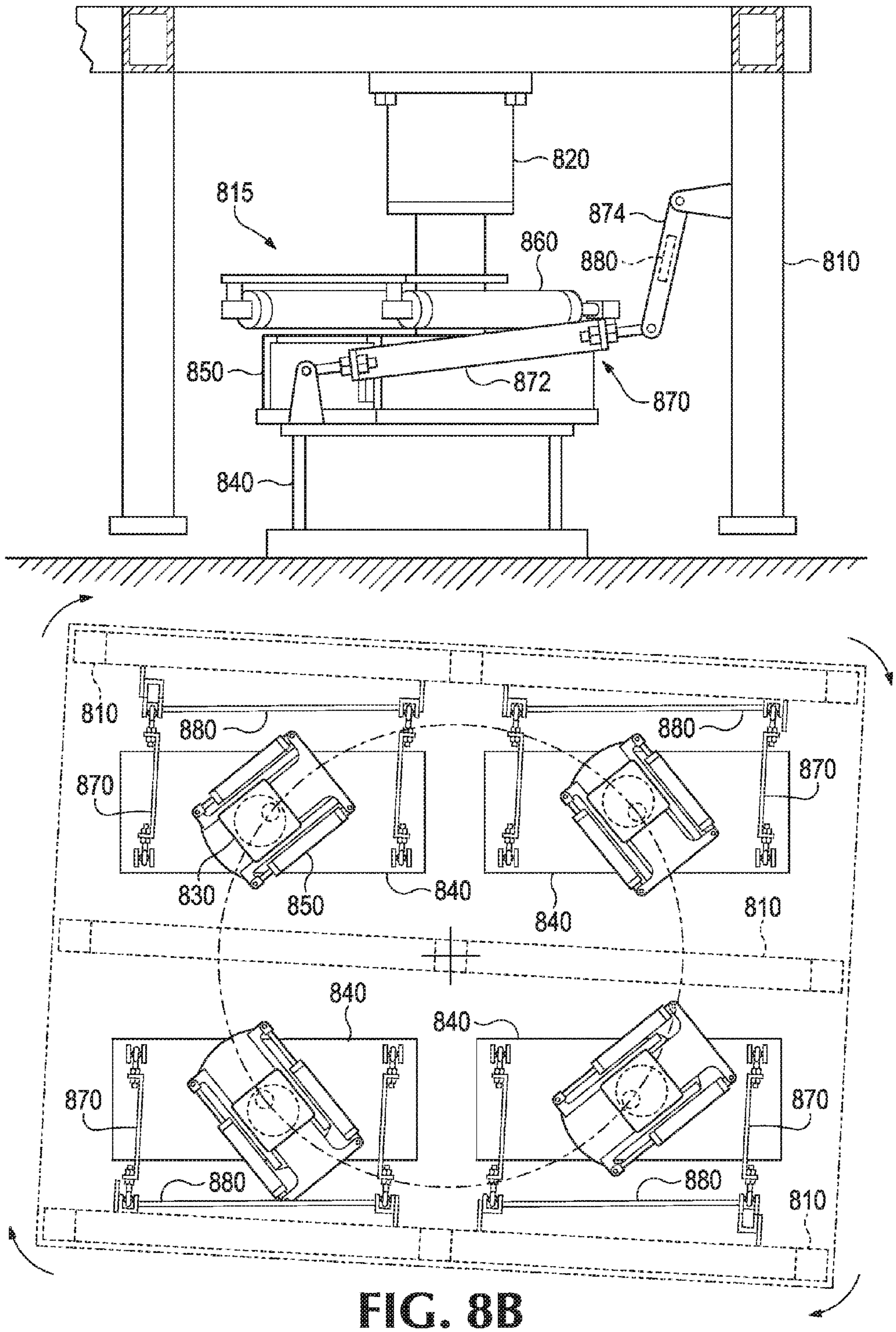
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FIG. 8B

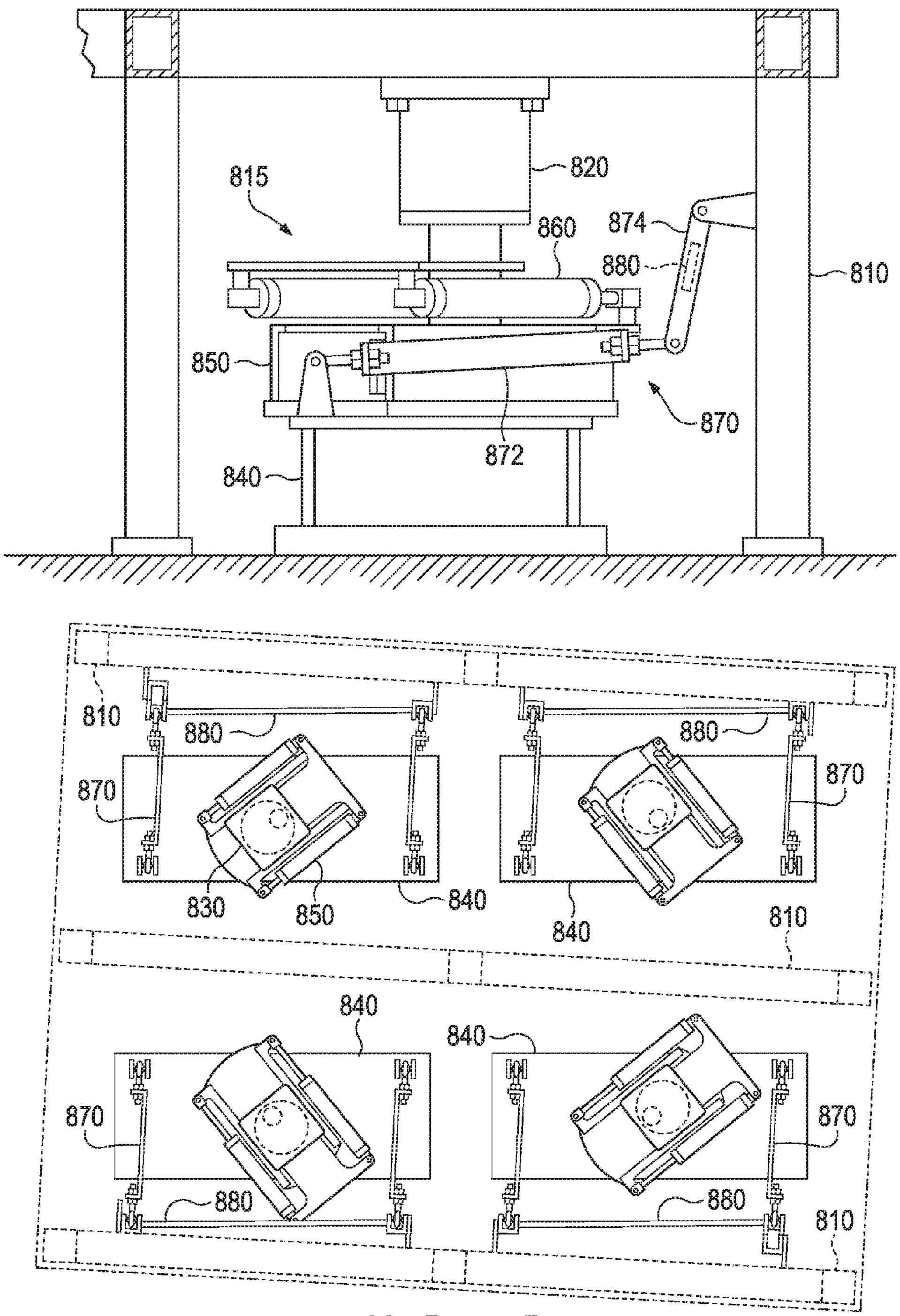
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FIG. 8C

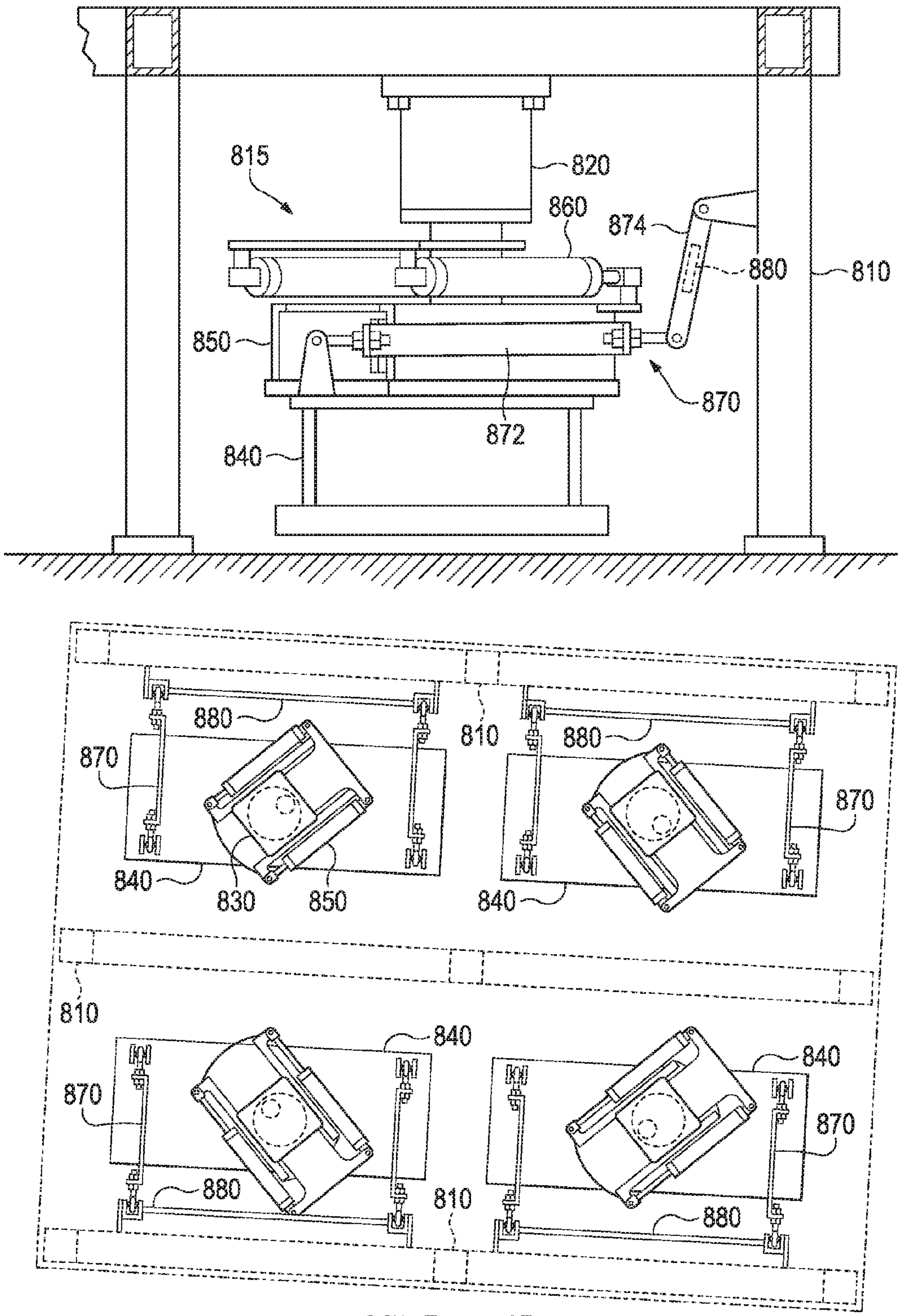
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FIG. 8D

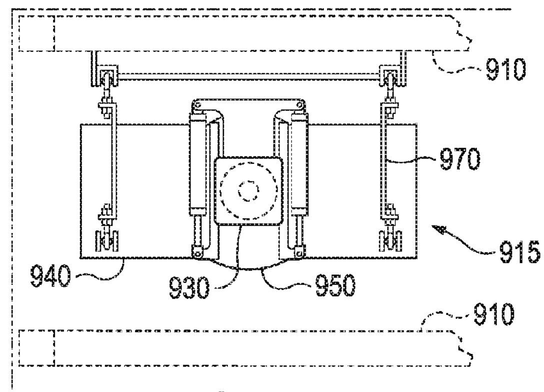

FIG. 9A

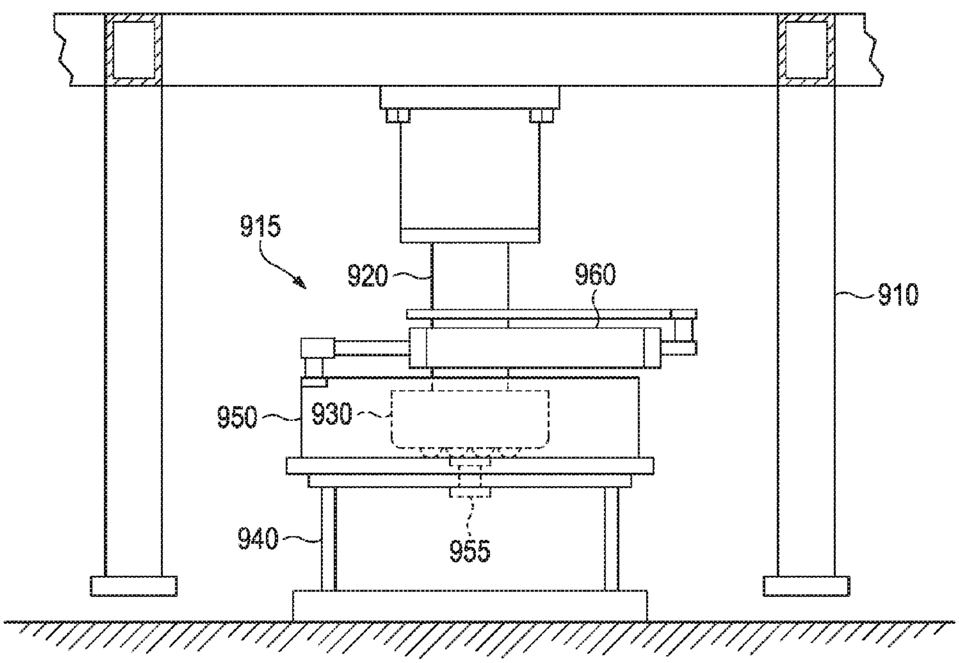

FIG. 9B

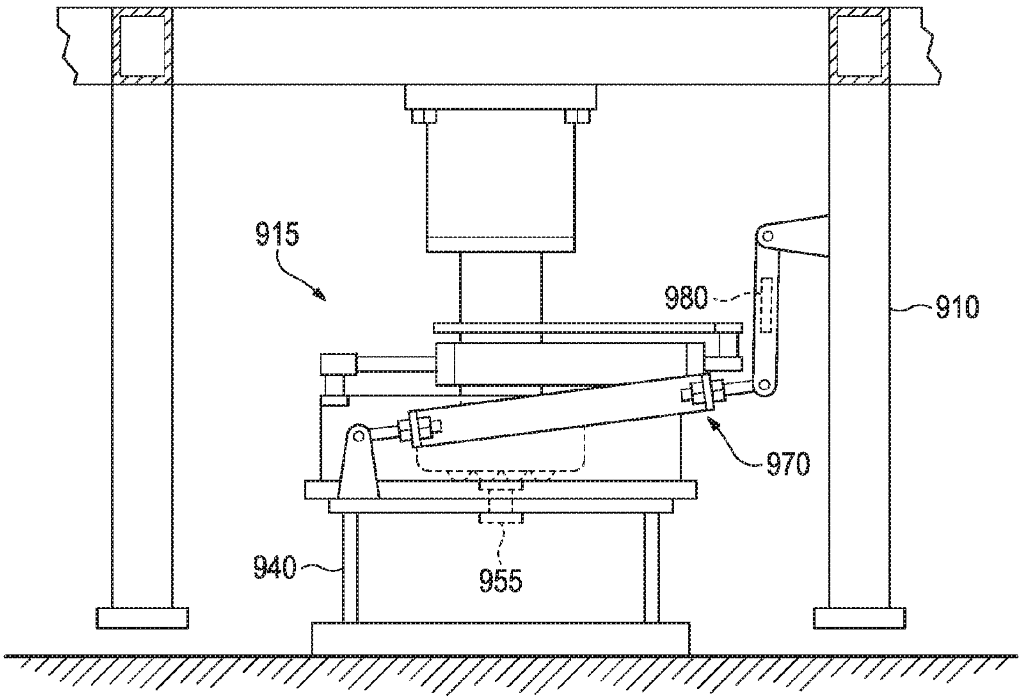
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FIG. 9C

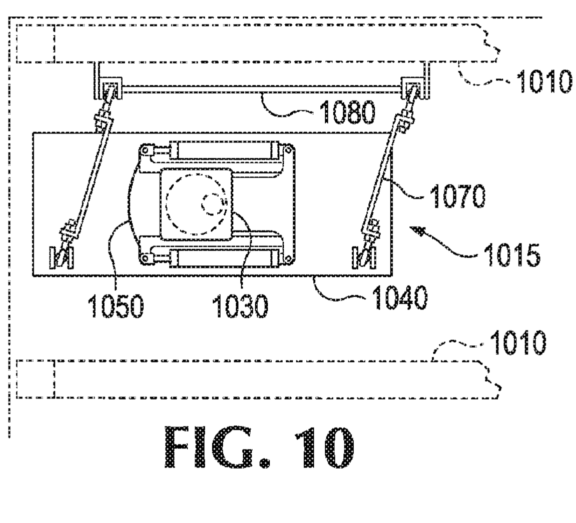
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FIG. 10

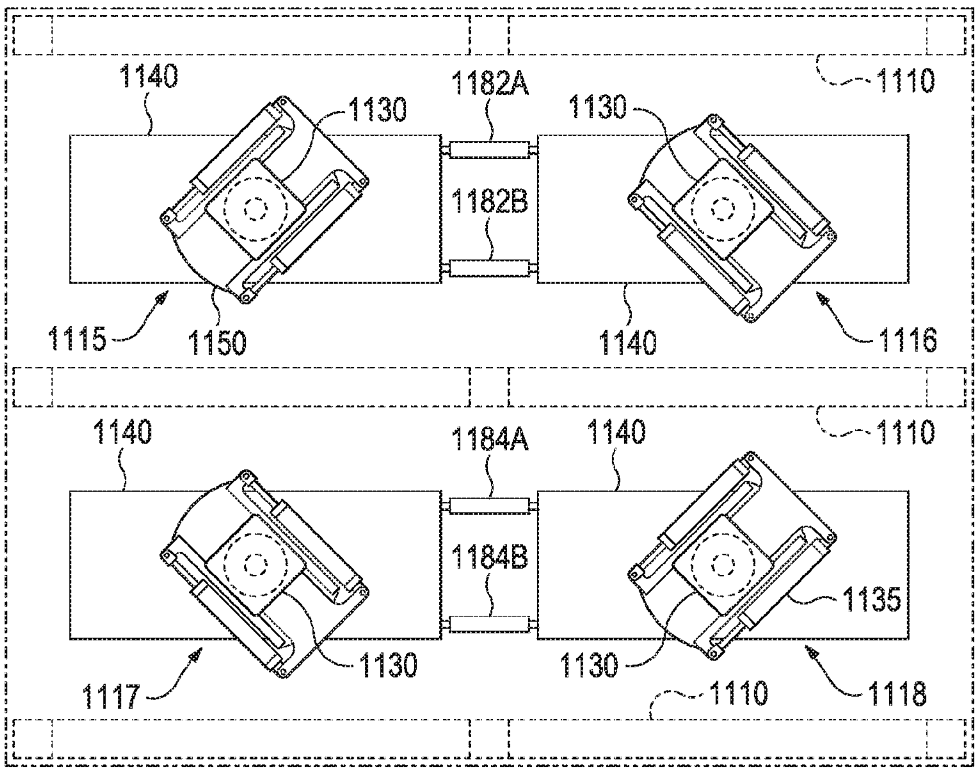
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FIG. 11

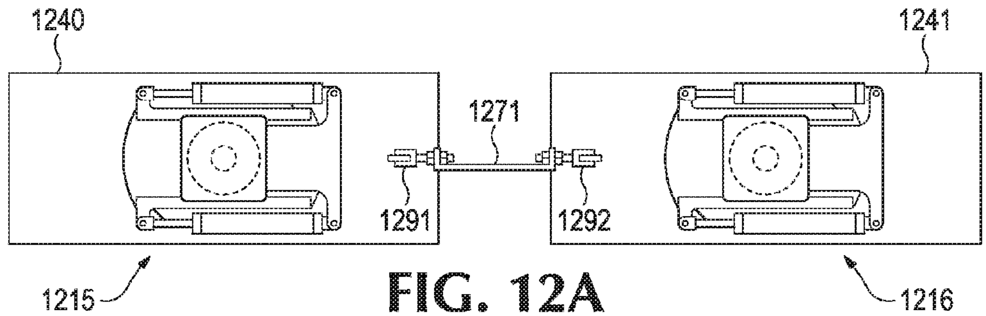

FIG. 12A

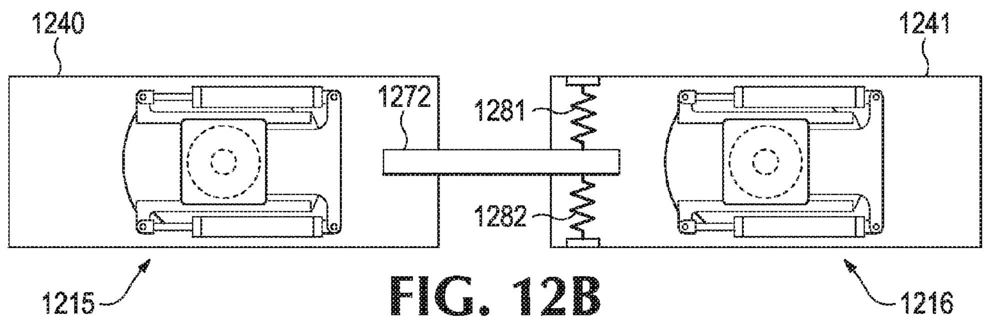

FIG. 12B

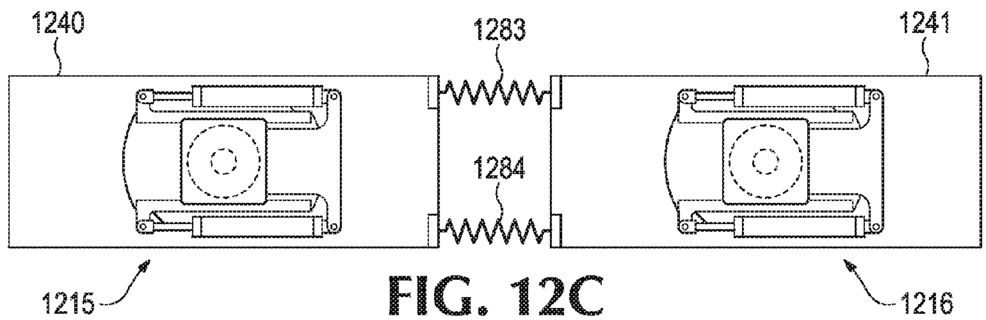

FIG. 12C

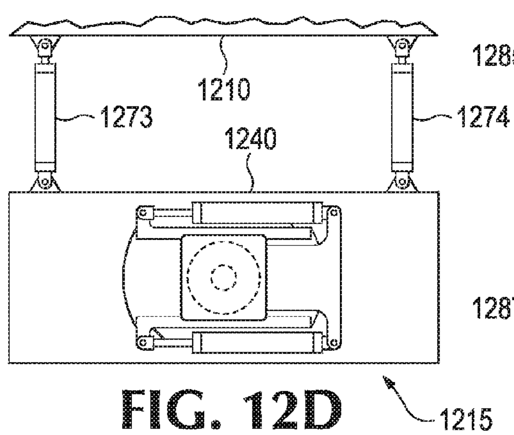

FIG. 12D

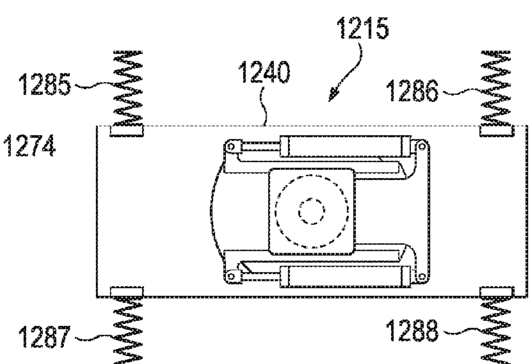

FIG. 12E

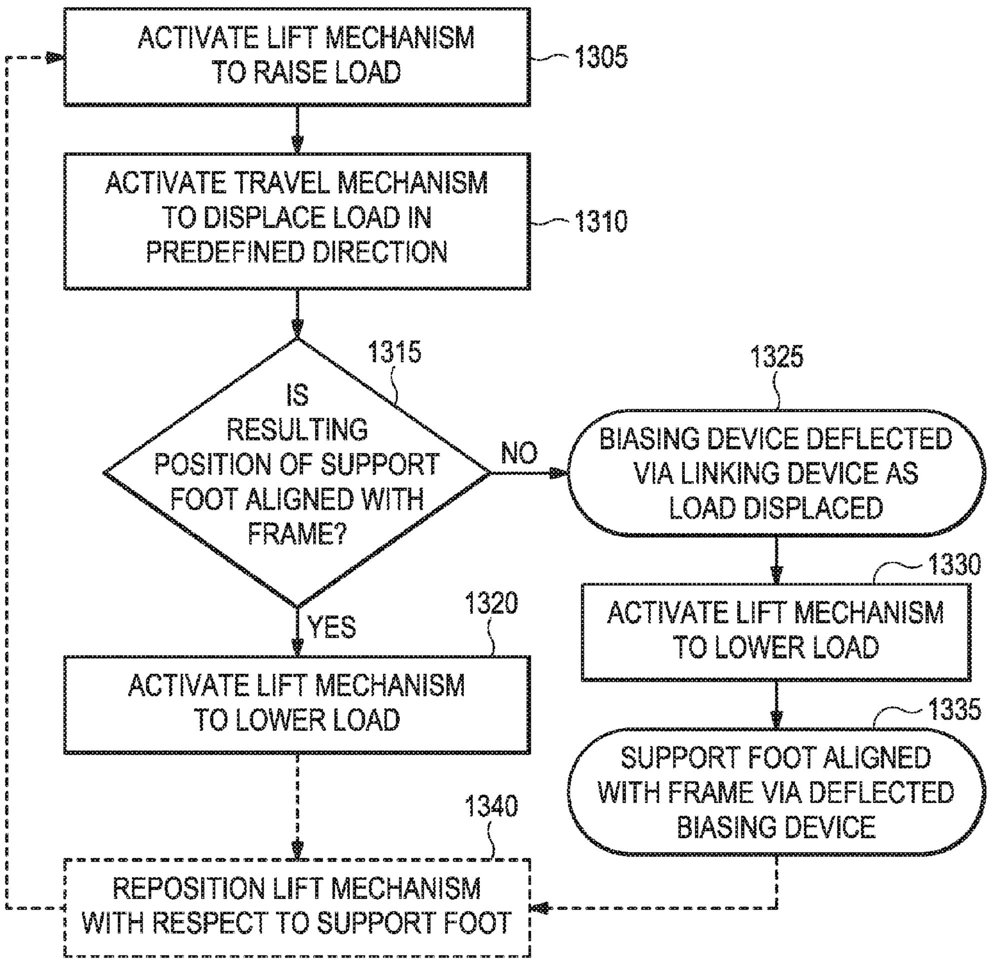
ACTIVATE LIFT MECHANISM TO RAISE LOAD
1305
ACTIVATE TRAVEL MECHANISM TO DISPLACE LOAD IN PREDEFINED DIRECTION
1310
1315
IS RESULTING POSITION OF SUPPORT FOOT ALIGNED WITH FRAME?
NO
1325
BIASING DEVICE DEFLECTED VIA LINKING DEVICE AS LOAD DISPLACED
1330
ACTIVATE LIFT MECHANISM TO LOWER LOAD
YES
1320
ACTIVATE LIFT MECHANISM TO LOWER LOAD
1335
SUPPORT FOOT ALIGNED WITH FRAME VIA DEFLECTED BIASING DEVICE
1340
REPOSITION LIFT MECHANISM WITH RESPECT TO SUPPORT FOOT

FIG. 13

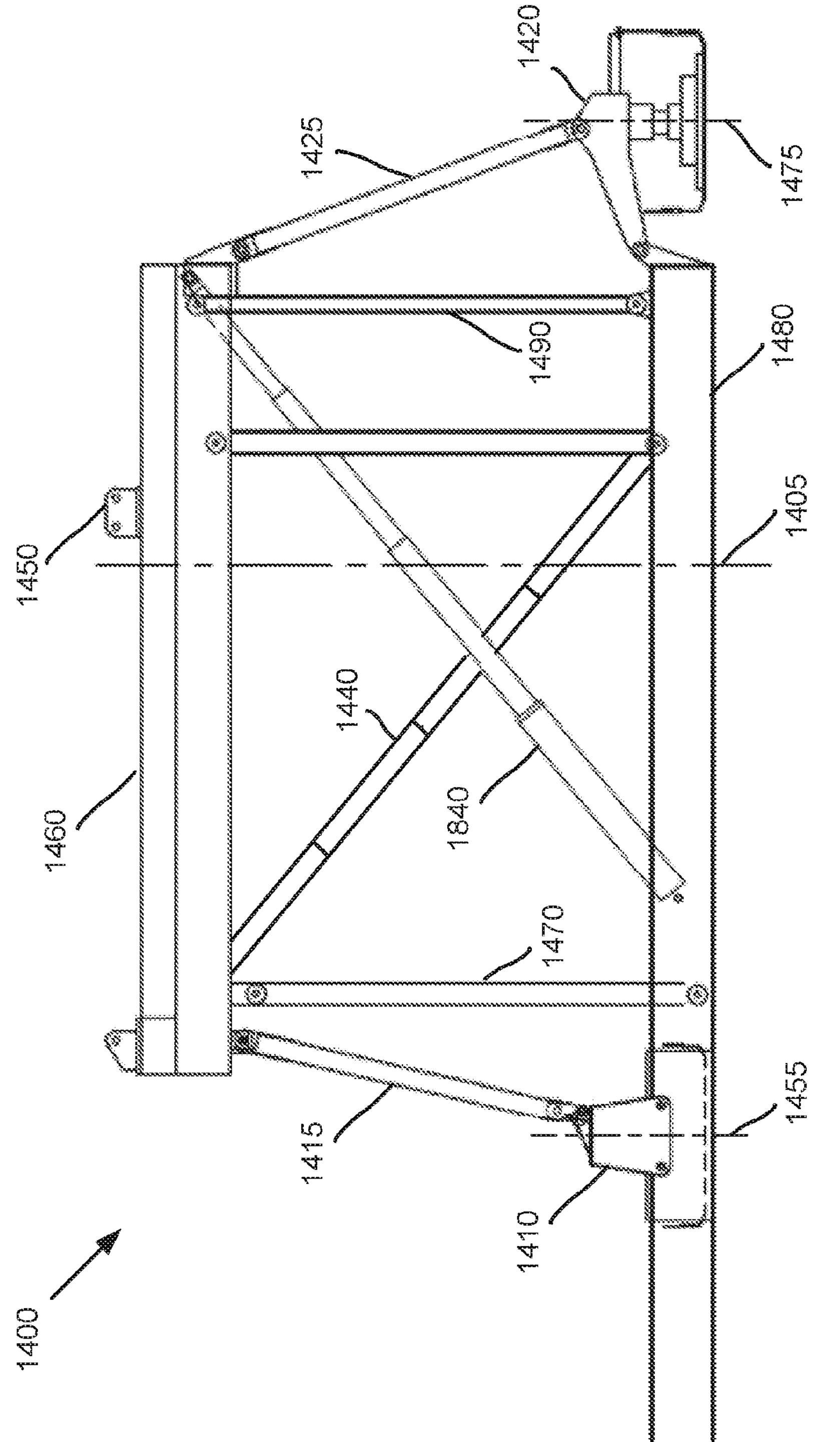
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FIG. 14

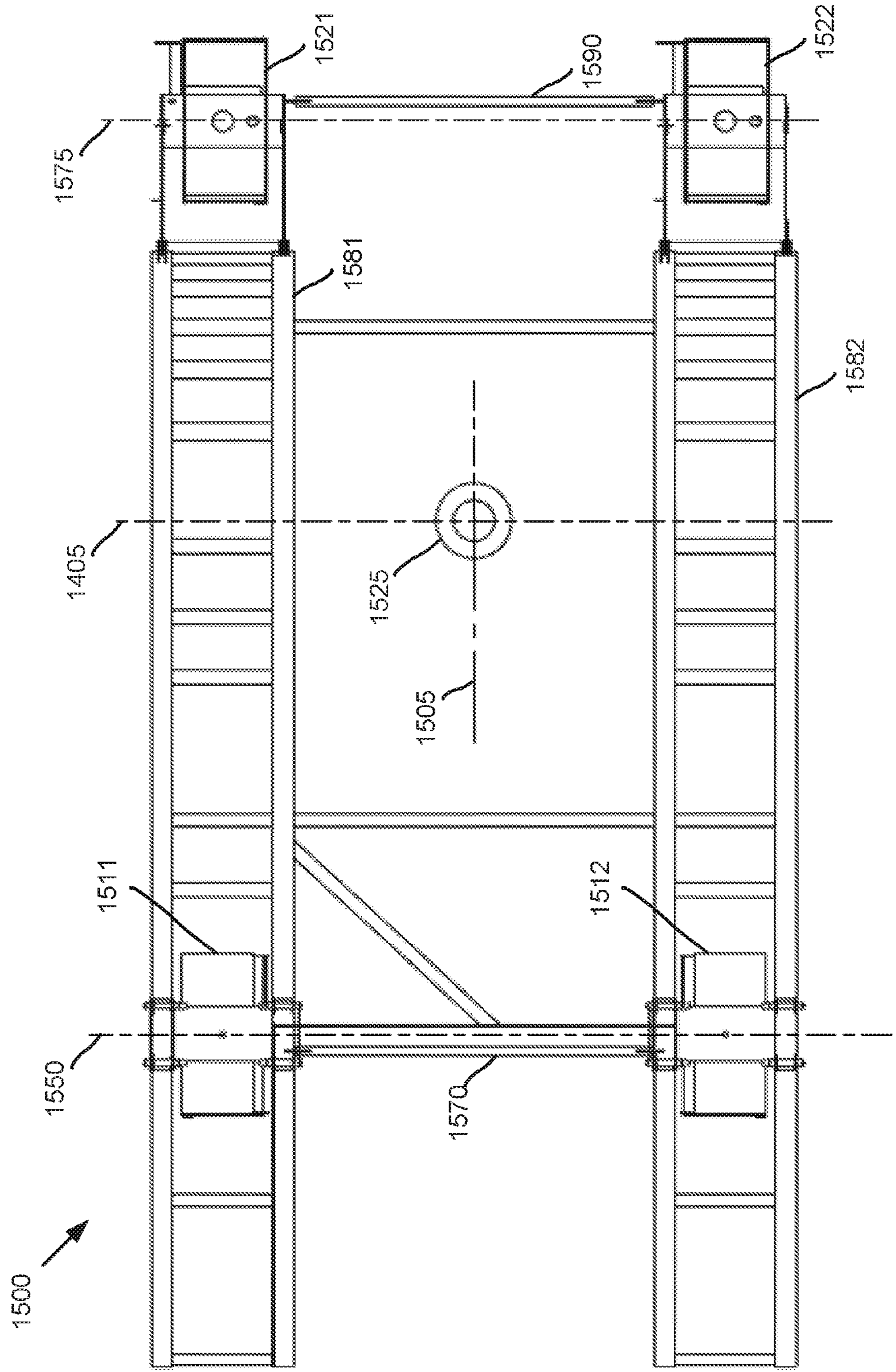
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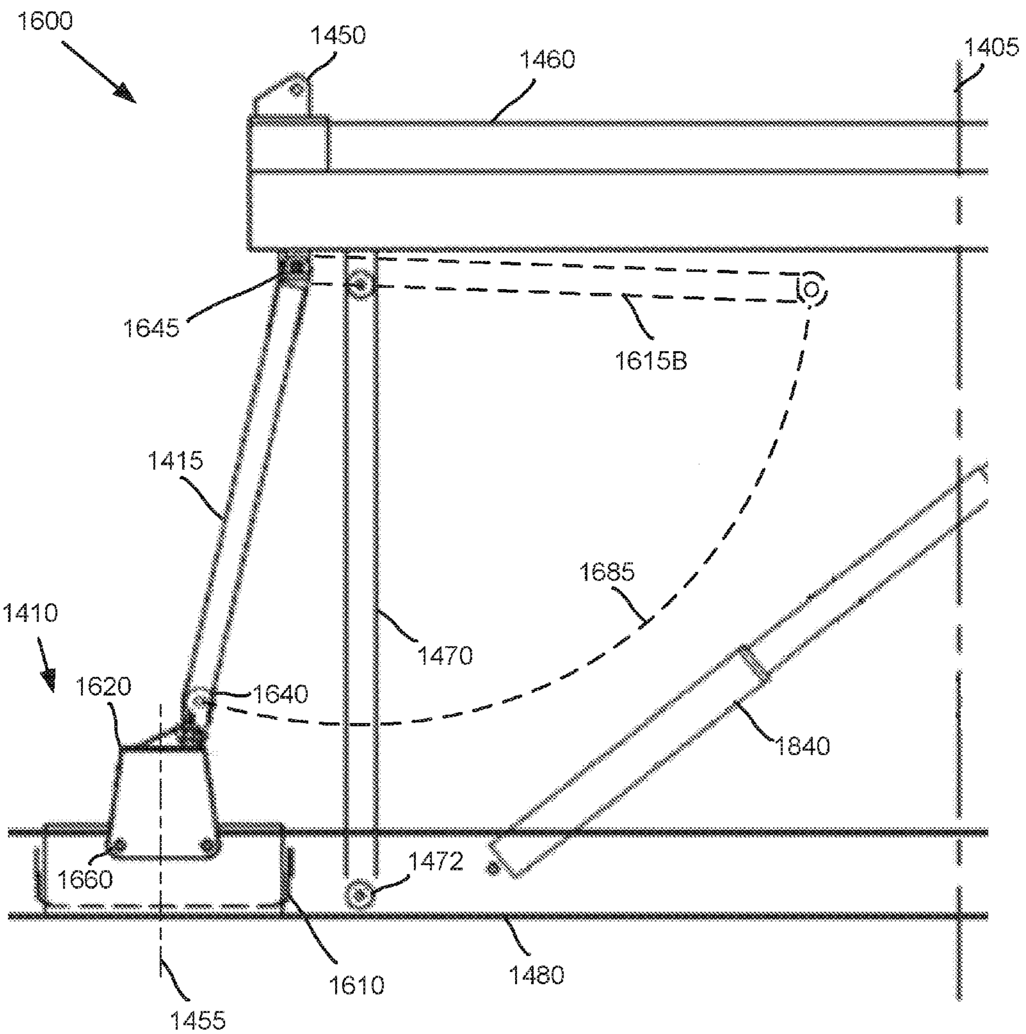
FIG. 15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1480
1455

FIG. 16

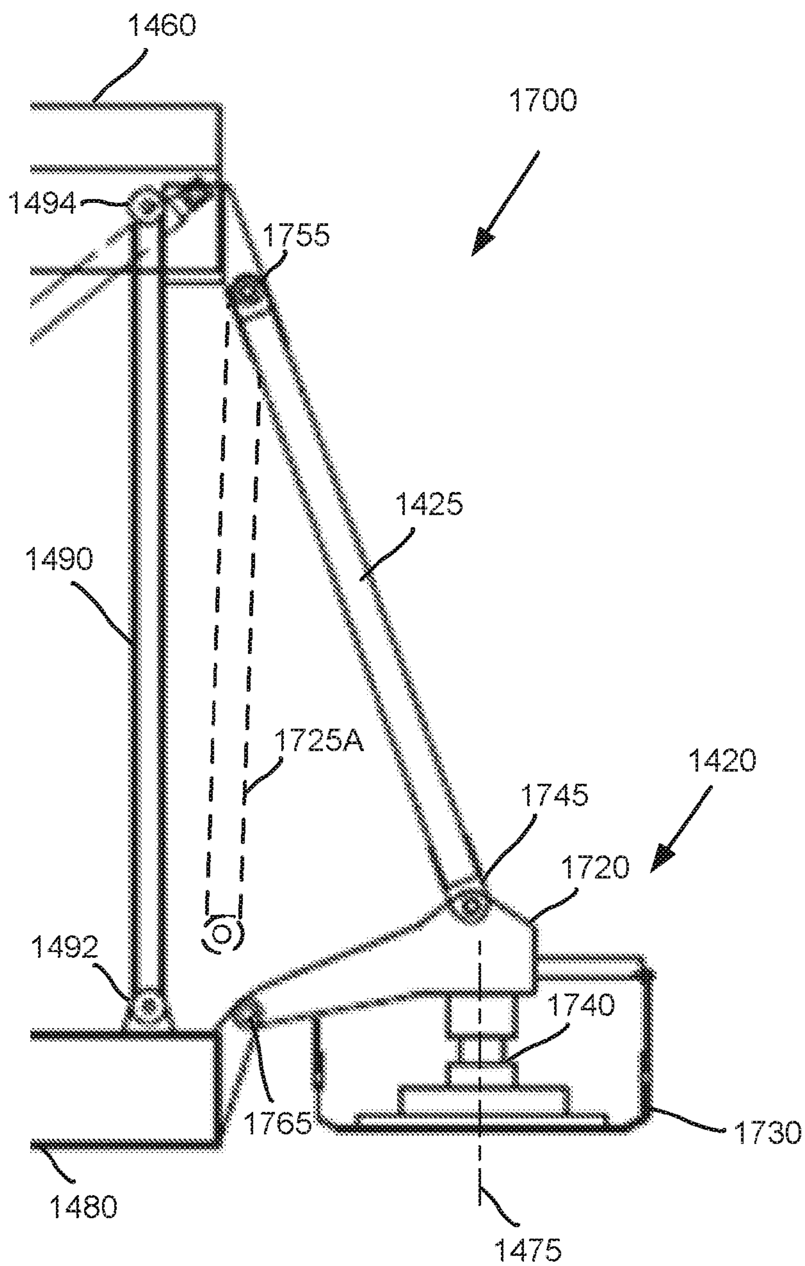
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FIG. 17

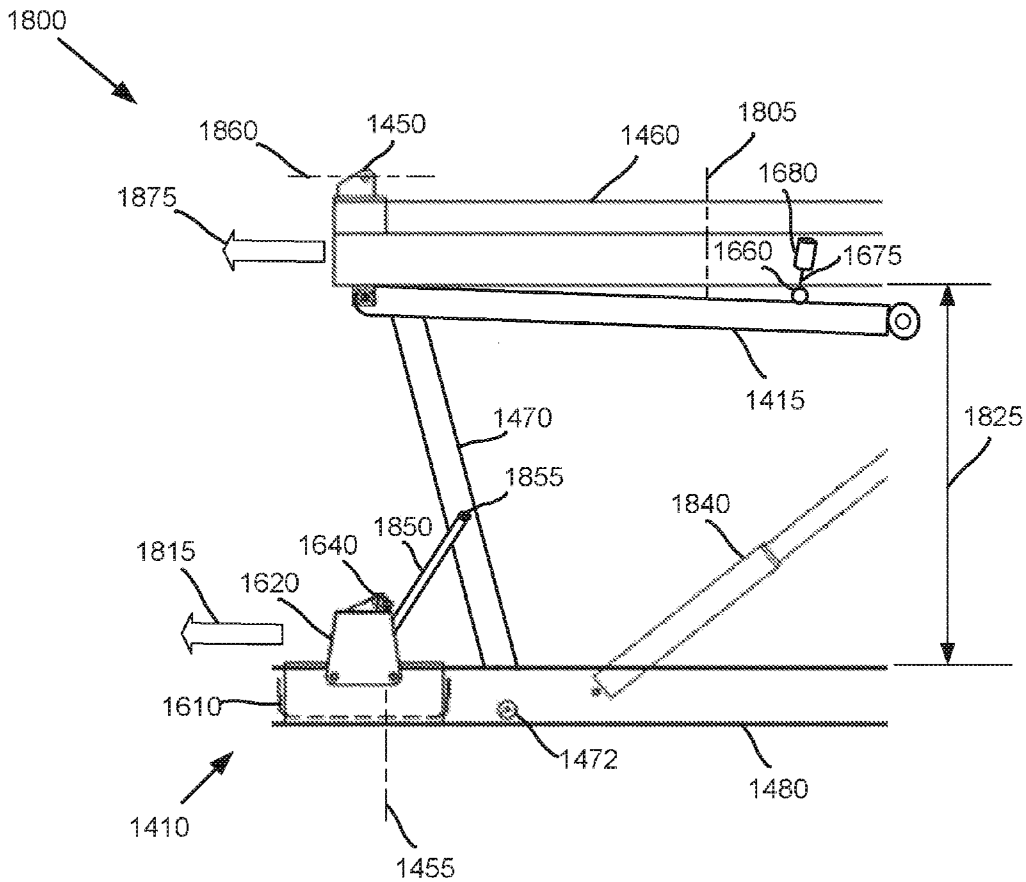
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FIG. 18A

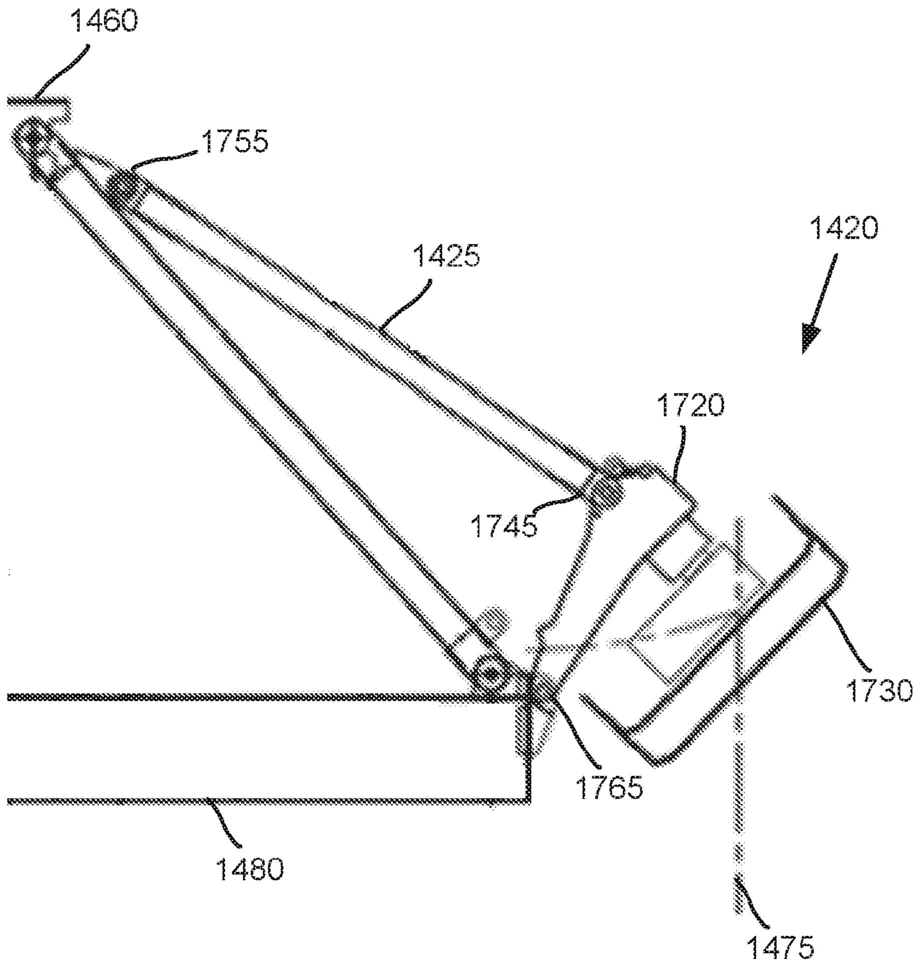

FIG. 18B

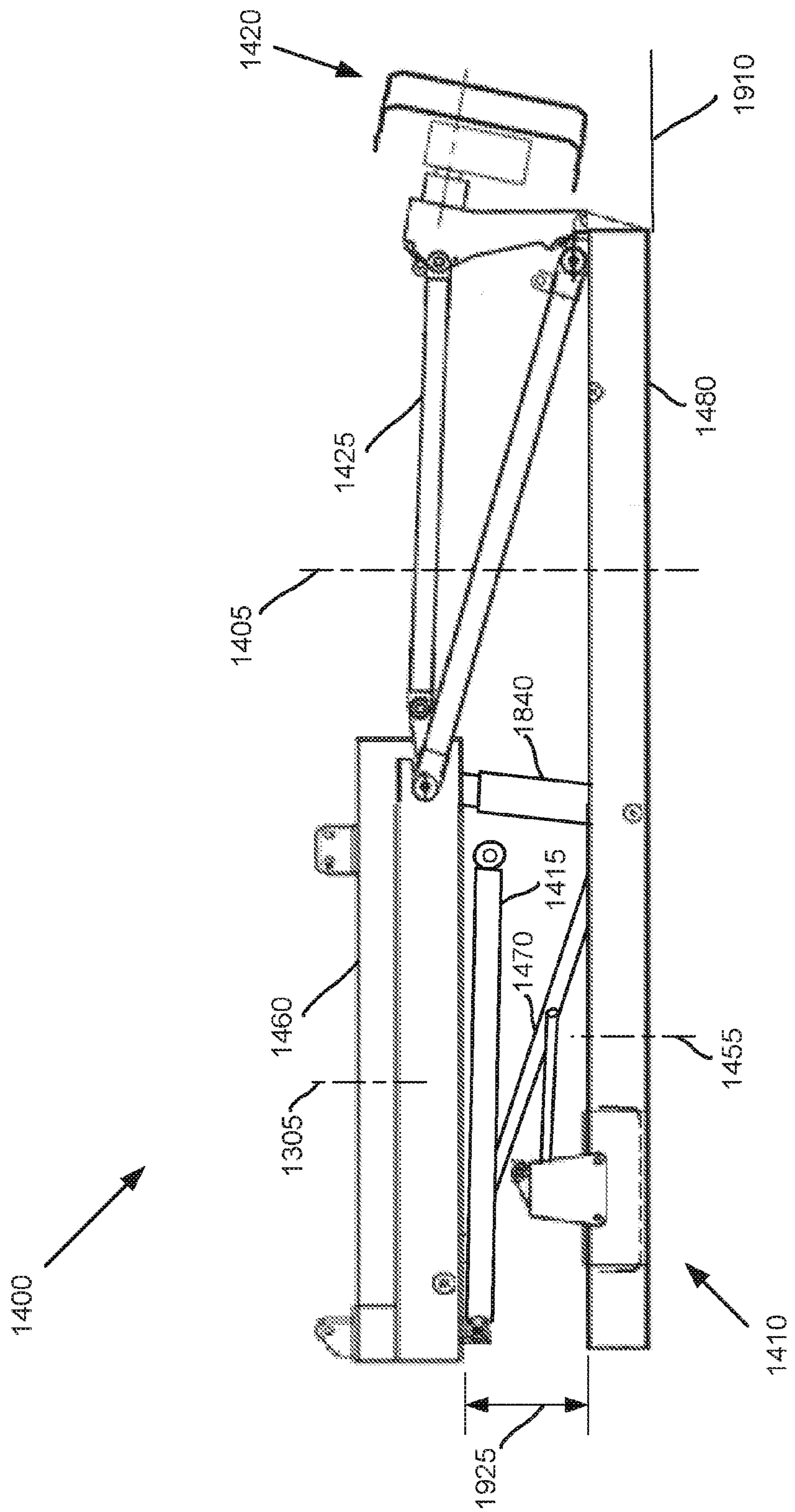
1420
1910
1425
1480
1405
1840
1415
1470
1460
1455
1305
1400
1410
1925

FIG. 19

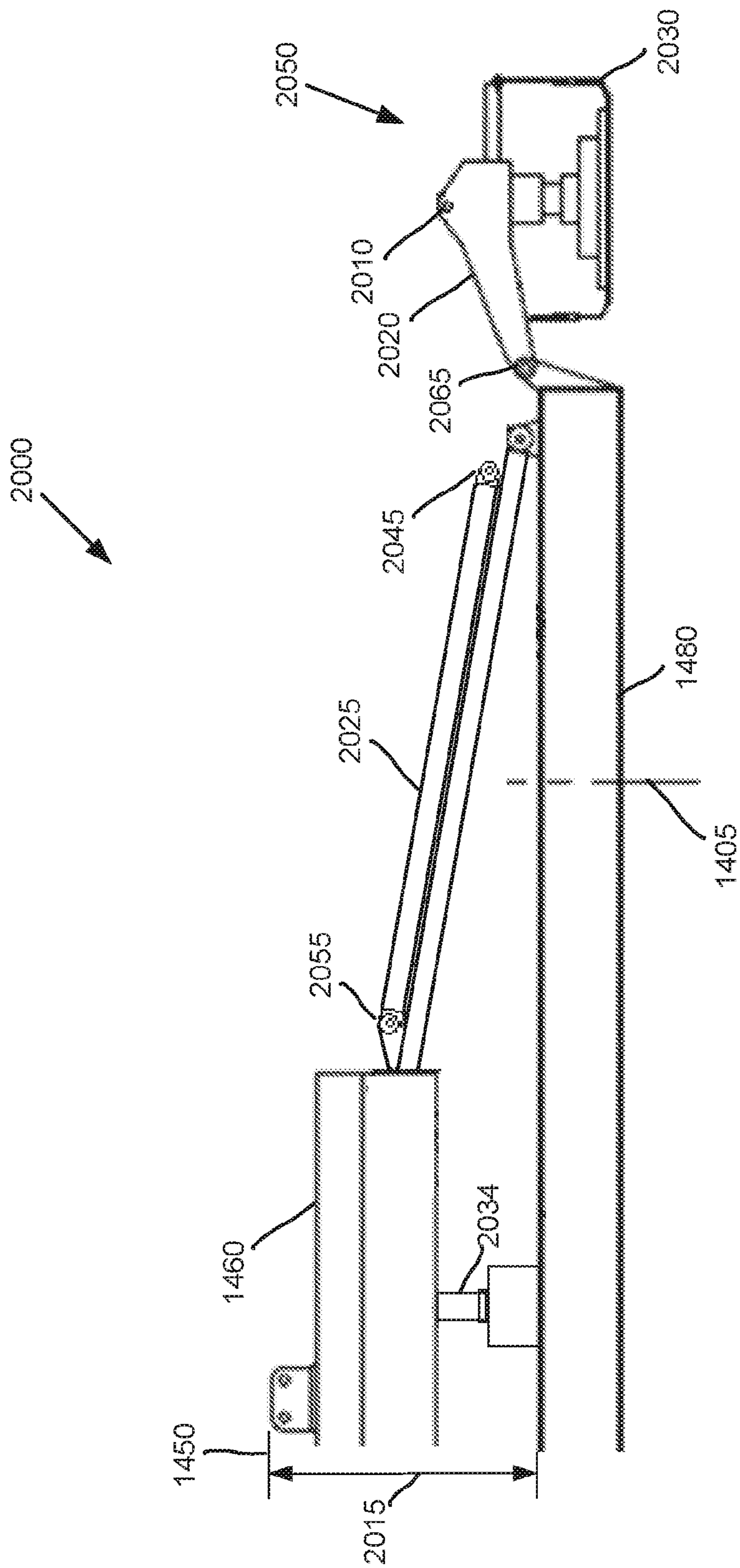
2050
2030
2010
2020
2065
2000
2045
1480
2025
1405
2055
2034
1460
1450
2015

FIG. 20

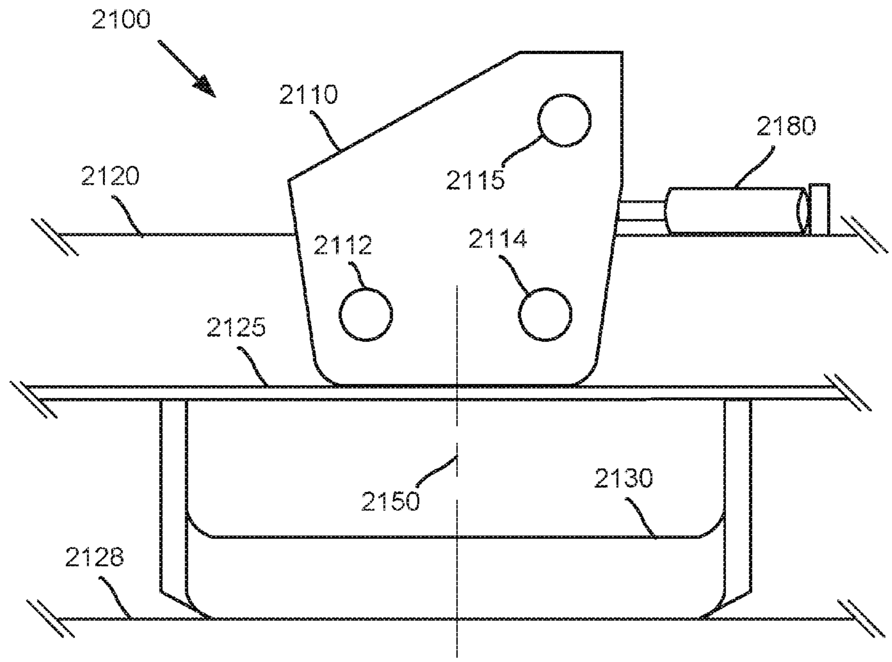
2100
2110
2180
2120
2115
2112
2114
2125
2150
2130
2128

FIG. 21

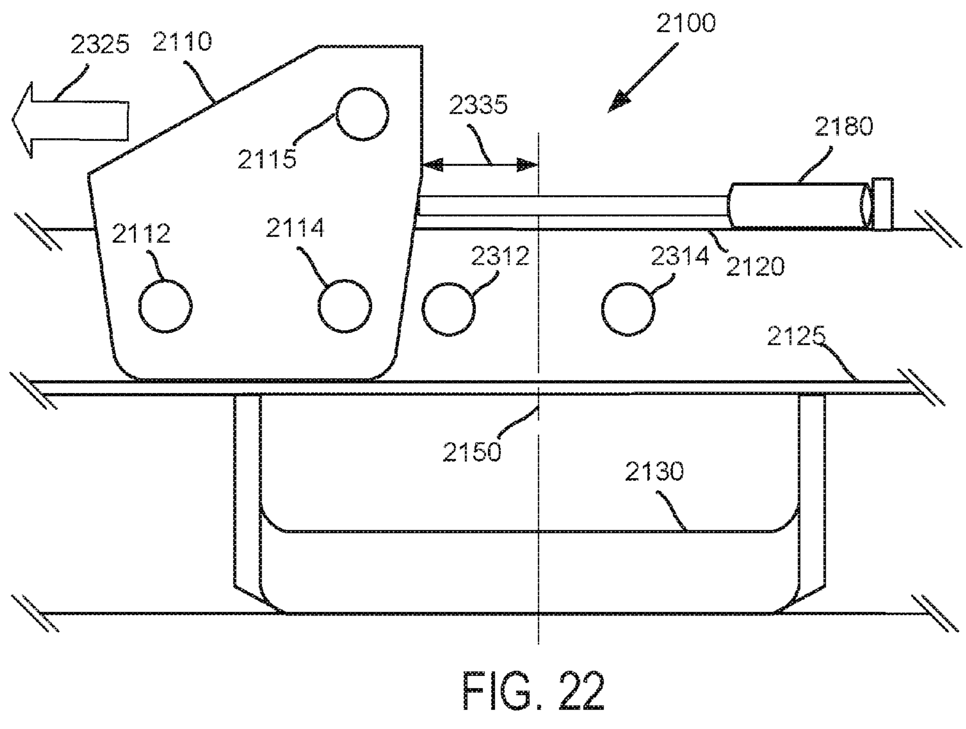
2325
2110
2100
2335
2180
2115
2112
2114
2312
2314
2120
2125
2150
2130

FIG. 22

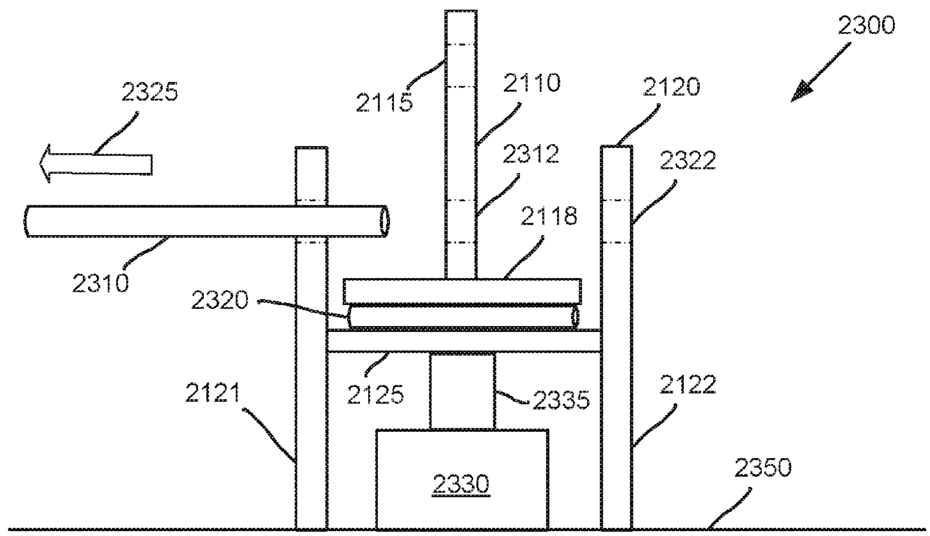
2300
2325
2115
2110
2120
2312
2322
2118
2310
2320
2125
2335
2121
2122
2330
2350

FIG. 23

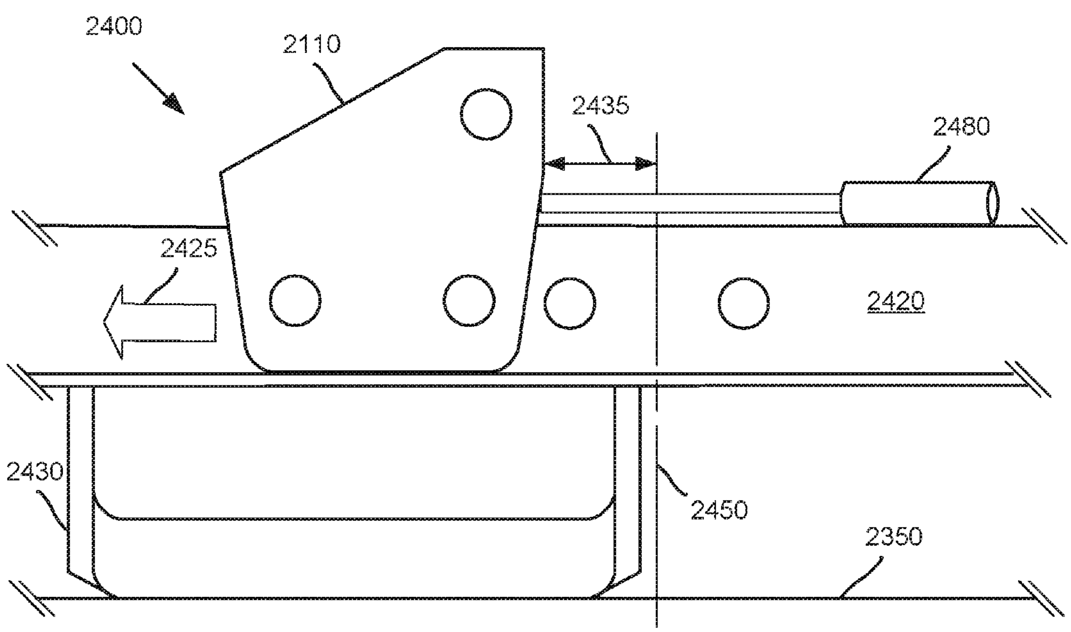
2400
2110
2435
2480
2425
2420
2430
2450
2350

FIG. 24

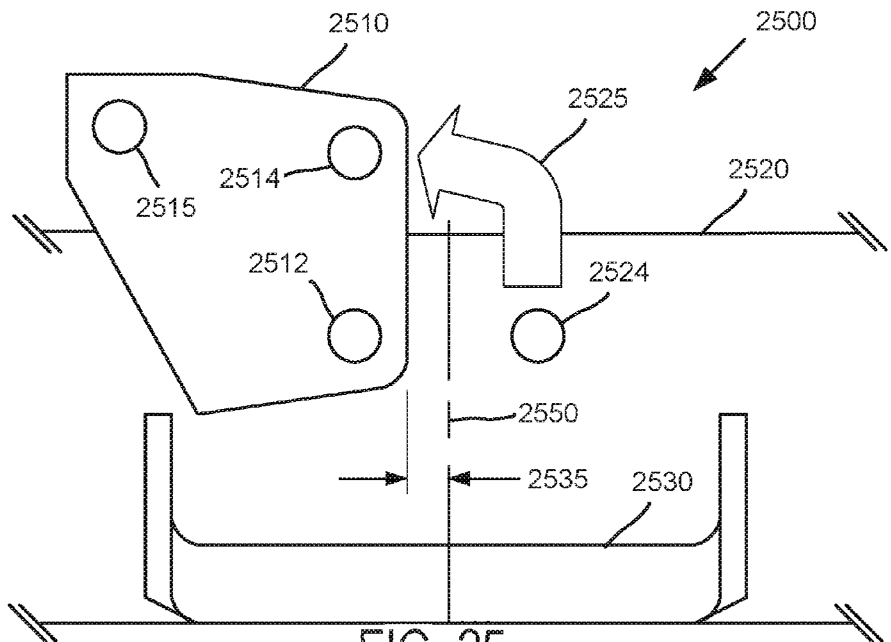
2510
2500
2525
2520
2514
2515
2512
2524
2550
2535
2530

FIG. 25

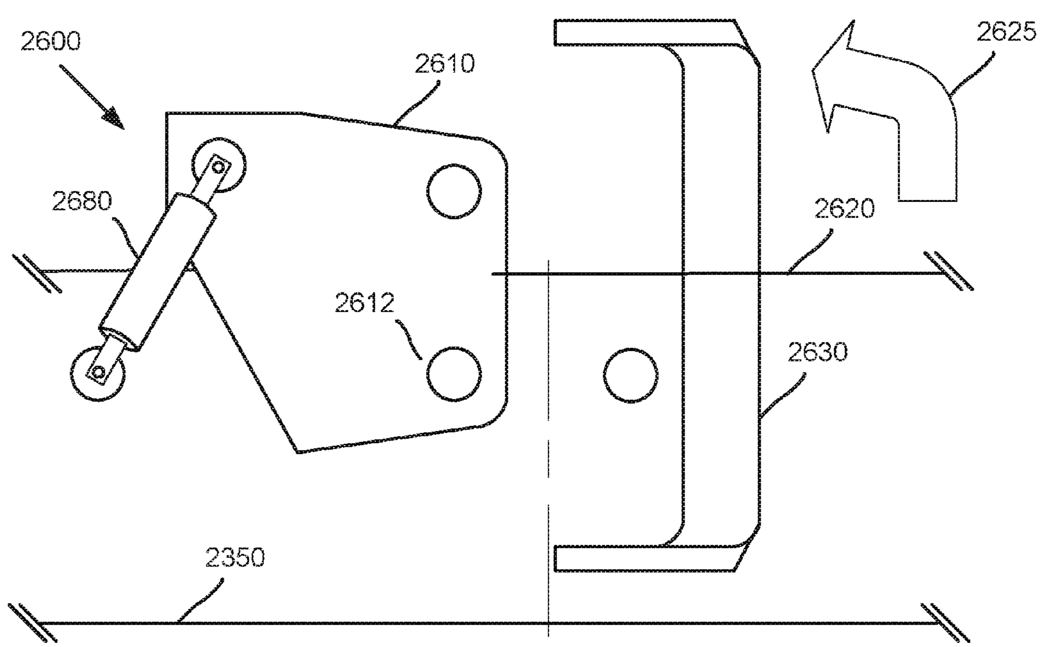
2600
2610
2625
2680
2620
2612
2630
2350

FIG. 26

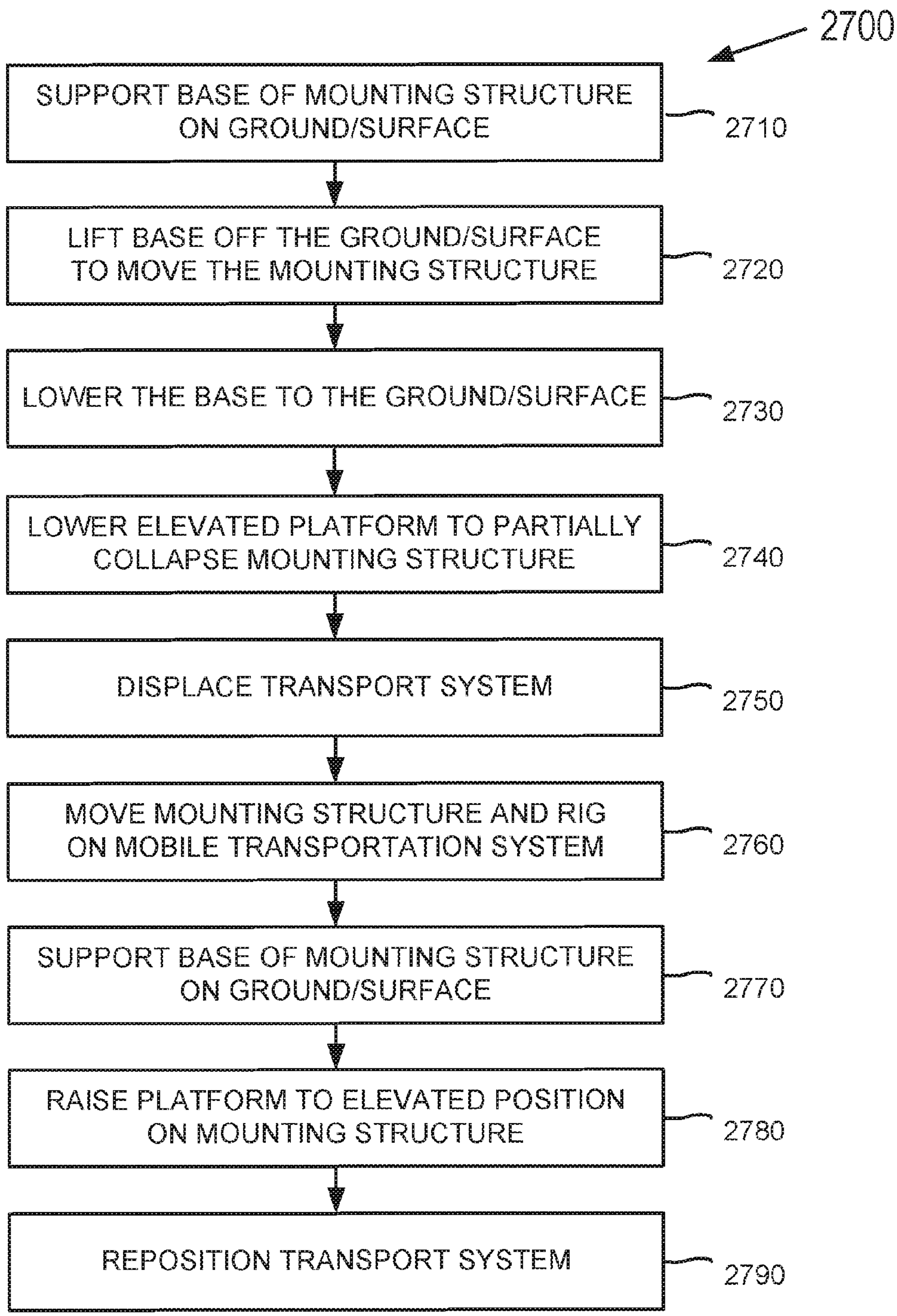
2700
SUPPORT BASE OF MOUNTING STRUCTURE ON GROUND/SURFACE
2710
LIFT BASE OFF THE GROUND/SURFACE TO MOVE THE MOUNTING STRUCTURE
2720
LOWER THE BASE TO THE GROUND/SURFACE
2730
LOWER ELEVATED PLATFORM TO PARTIALLY COLLAPSE MOUNTING STRUCTURE
2740
DISPLACE TRANSPORT SYSTEM
2750
MOVE MOUNTING STRUCTURE AND RIG ON MOBILE TRANSPORTATION SYSTEM
2760
SUPPORT BASE OF MOUNTING STRUCTURE ON GROUND/SURFACE
2770
RAISE PLATFORM TO ELEVATED POSITION ON MOUNTING STRUCTURE
2780
REPOSITION TRANSPORT SYSTEM
2790

FIG. 27

ALIGNMENT RESTORATION DEVICE FOR LOAD TRANSPORTING APPARATUS

STATEMENT OF RELATED MATTERS

This application claims priority to and is a continuation of U.S. patent application Ser. No. 14/529,566, filed Oct. 31, 2014. U.S. patent application Ser. No. 14/529,566 is a continuation-in-part of U.S. patent application Ser. No. 13/909,969, filed Jun. 4, 2013, now U.S. Pat. No. 9,096,282, issued Aug. 4, 2015, which claims priority to U.S. Provisional Application No. 61/757,517, filed Jan. 28, 2013.

U.S. patent application Ser. No. 13/909,969 is a continuation-in-part of U.S. patent application Ser. No. 13/711,193, filed Dec. 11, 2012, now U.S. Pat. No. 8,573,334, issued Nov. 5, 2013, which claims priority to U.S. Provisional Application No. 61/576,657, filed Dec. 16, 2011. U.S. patent application Ser. No. 13/909,969 is also a continuation-in-part of U.S. patent application Ser. No. 13/711,269, filed Dec. 11, 2012, now U.S. Pat. No. 8,561,733, issued Oct. 22, 2013, which claims priority to U.S. Provisional Application No. 61/576,657, filed Dec. 16, 2011. Additionally, U.S. patent application Ser. No. 13/909,969 is a continuation-in-part of U.S. patent application Ser. No. 13/711,315, filed Dec. 11, 2012, now U.S. Pat. No. 8,490,724, issued Jul. 23, 2013, which claims priority to U.S. Provisional Application No. 61/576,657, filed Dec. 16, 2011.

The contents of all the above patents and patent applications are herein incorporated by reference in their entireties.

TECHNICAL FIELD

This disclosure generally relates to systems, devices and methods for transporting a mounting structure configured to support a rig and/or a heavy load.

BACKGROUND

Moving extremely heavy loads has generally been a complicated task because of the large forces involved in lifting and transporting the heavy loads. In known mounting structures, large loads may be transported by disassembling or breaking up the load or the mounting structure into multiple smaller sections and/or loads. However, this breakdown and subsequent reassembly process can be very time consuming, especially when a heavy load is only to be moved a small distance, or needs to be repositioned.

For heavy loads that need periodic movement or adjustment, devices commonly referred to as “walking machines” or “walkers” were developed. These machines may be configured to move the heavy loads over small distances in incremental stages. For example, walking machines may be used to move large structures, such as oil rigs, in order to position them over pre-drilled pipes in oil fields.

Instead of using wheels driven by rotational forces to move heavy loads, walking machines typically use hydraulic lift cylinders to lift the load above a supporting surface, and then move or rotate the load relative to the supporting surface by transporting the load via rollers or tracks in the walking machines. U.S. Pat. No. 5,921,336 to Reed and U.S. Pat. No. 6,581,525 to Smith show two methods of using walking machines to move heavy loads, such as oil rig structures. The ’525 patent shows elongated beams under several rollers and lift cylinders, which allows the load from the lift cylinders and rollers to be spread over a large area. However, this disclosed system in the ’525 patent does not allow for movement of heavy load in a direction perpendicular to the long axis of the support beams. That is, movement of the heavy load is restricted in the walking device disclosed in the ’525 patent to only particular directions, which can make fine tuning of the position of the heavy load difficult.

The inclusion of a walking system to a mounting structure may involve additional support structures or connections in order to transfer the weight of the mounting structure and/or load to the walking system. The support structures and/or connections may require additional time for assembly and/or disassembly during various operations associated with the mounting structure, such as operations associated with storage and/or transportation of the mounting structure over relatively large distances.

The present invention addresses these and other problems.

SUMMARY

Embodiments of the present invention are directed to a load transporting apparatus that automatically aligns a support foot of the apparatus with a load-bearing, frame connected to the load transporting apparatus during a recovery phase of an incremental walking movement. In particular, the load transporting apparatus includes a linking device attached to a support foot of the apparatus and a biasing device connected to the linking device that is deflected during non-linear load transporting movements, where the biasing device acts to automatically return the support foot to an aligned position relative to the load-bearing frame after a non-linear movement has been completed and the support foot is raised above a ground surface.

A mounting structure for a rig is herein disclosed as comprising a base configured to support the mounting structure on an operating surface and a plurality of transport systems operatively connected to the base and configured to lift the mounting structure off of the operating surface. An elevated rig platform may be connected to the base by a plurality of support struts. At least some of the support struts comprise a mounting connection that is configured to pivot to lower the elevated rig platform toward the base and place the mounting structure in a partially collapsed state. Additionally, a connecting member may be attached to one or more of the plurality of transport systems. In response to the elevated rig platform being lowered to the partially collapsed state, the connecting member may be configured to displace at least a portion of the one or more transport systems while the base remains in contact with the operating surface.

In some examples, a mounting structure for a rig may comprise a base configured to support the mounting structure on an operating surface, and means for lifting the base off of the operating surface. An elevated rig platform may be connected to the base by a plurality of support struts. At least some of the support struts may comprise a mounting connection that pivots to lower the elevated rig platform toward the base and place the mounting structure in a partially collapsed state. Additionally, the mounting structure may comprise means for displacing at least a portion of the means for lifting in response to the elevated rig platform being lowered to the partially collapsed state. The portion of the means for lifting may be displaced while the base remains in contact with the operating surface.

Further disclosed herein is a method for placing a mounting structure in a partially collapsed state. The method may comprise supporting a base of the mounting structure on an operating surface and lifting, with a transport system, the base off of the operating surface to move the mounting

structure to a destination. The transport system may be configured to lower the base to contact the operating surface at the destination. In some examples, an elevated platform may be connected to the base by a plurality of support struts. The elevated platform may be lowered while the base is in contact with the operating surface. At least some of the support struts comprise a mounting connection that pivots to lower the elevated rig platform toward the base. Additionally, the method may comprise displacing, with a connecting member, at least a portion of the transport system in response to the elevated rig platform being lowered. The portion of the transport system may be displaced by the connecting member while the base remains in contact with the operating surface.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B are diagrams of walking apparatuses attached to various loads according to embodiments of the invention.

FIGS. **2**A, **2**B, **2**C, **2**D, **2**E, and **2**F are detail diagrams showing an example operational progression of walking apparatuses to move a load according to embodiments of the invention.

FIGS. **3**A and **3**B are diagrams illustrating example connection arrangements used to connect a walking apparatus to a load according to embodiments of the invention.

FIG. **4** is a schematic diagram illustrating movement of a load along a substantially linear path according to embodiments of the invention.

FIG. **5** is a schematic diagram illustrating movement of a load along a curved path according to embodiments of the invention.

FIG. **6** is a schematic diagram of a top view of a walking apparatus according to embodiments of the invention.

FIG. **7**A is a side view of an example walking apparatus in a recovery position according to embodiments of the invention.

FIG. **7**B is a side view of the example walking apparatus shown in FIG. **7**A in a load-movement position according to embodiments of the invention.

FIGS. **8**A, **8**B, **8**C, and **8**D are side and top views of walking apparatuses that illustrate an example operation progression of a load transporting system according to embodiments of the invention.

FIG. **9**A is a top view of a walking apparatus in a perpendicular orientation according to embodiments of the invention.

FIG. **9**B is a side view of the walking apparatus shown in FIG. **9**A in a load-movement position according to embodiments of the invention.

FIG. **9**C is a side view of the walking apparatus shown in FIG. **9**A in a recovery position according to embodiments of the invention.

FIG. **10** is a top view of a walking apparatus after a load-movement phase of a walking cycle completed in a parallel direction according to embodiments of the invention.

FIG. **11** is a top view of a load movement system according to embodiments of the invention.

FIGS. **12**A, **12**B, **12**C, **12**D, and **12**E are diagrams of walking apparatuses with various alignment restoration devices according to embodiments of the invention.

FIG. **13** is a flow diagram illustrating method of operating a load transporting apparatus according to embodiments of the invention.

FIG. **14** illustrates an example mounting structure.

FIG. **15** illustrates a bottom view of a mounting structure.

FIG. **16** illustrates an enlarged partial view of a mounting structure comprising a first support structure.

FIG. **17** illustrates an enlarged partial view of a mounting structure comprising a second support structure.

FIG. **18**A illustrates a first portion of the mounting structure of FIG. **14** in a partially collapsed transport/storage position.

FIG. **18**B illustrates a second portion of the mounting structure of FIG. **14** in a partially collapsed transport/storage position.

FIG. **19** illustrates the mounting structure of FIG. **14** in a fully collapsed position.

FIG. **20** illustrates a mounting structure, such as the mounting structure of FIG. **14**, in an alternative example transport/storage position.

FIG. **21** illustrates an example support structure.

FIG. **22** illustrates the example support structure of FIG. **21** in a transport/storage position.

FIG. **23** illustrates a further example support structure.

FIG. **24** illustrates an example support structure in a transport/storage position.

FIG. **25** illustrates a further example support structure in a transport/storage position.

FIG. **26** illustrates yet another example support in a transport/storage position

FIG. **27** illustrates an example operation associated with a mounting structure having a storable transport system.

DETAILED DESCRIPTION

Walkers, or walking machines, may comprise one or more devices that are used for transporting very heavy loads, such as entire oil well drilling rigs. Such loads may be as heavy as several thousand tons and may be sequentially positioned very precisely over spaced-apart well bores, for example. Load transporting apparatuses or systems may include one or more walking machines, depending on the specific configuration of a walking system.

Embodiments of the present concept are directed to load transporting apparatuses, such as walking machines, for moving heavy loads over small distances with the ability to fine tune the resultant position of the heavy load. For ease of understanding, the terms, "walkers," "walking machines," "walking devices," and "walking apparatuses" are used interchangeably below. Load transporting apparatuses or systems may include one or more walking machines. Additionally, a walking machine's subassembly of components that facilitate movement of the walking machine are referred herein as a "walking mechanism." Walking machines may incorporate one or more walking mechanisms, depending on the specific configuration of a walking machine.

For example, with reference FIGS. **1**A and **1**B, a load transporting system includes multiple walking machines that support a load being carried by the load transporting system. FIGS. **1**A and **1**B show examples of walking apparatuses attached to various loads according to embodiments of the invention. Referring to FIG. **1**A, multiple walking apparatuses **115** are positioned under or adjacent to an oil rig **100**. Typically, walking machines **115** are positioned at least near edge portions of a load **100** to balance the weight of the load over the various walking machines. However, specific situations may dictate that walking machines **115** are positioned in various other locations relative to the load **100**.

Referring to FIG. **1**B, multiple walking apparatuses **116** are positioned under or adjacent to a silo **101**. Although an oil rig load **100** and a silo **101** are respectively illustrated in

FIGS. **1**A and **1**B, walking machines may be used to move any type of relatively large load, such as bridge sections, ship sections, structures, etc. Additionally, although two walking machines are shown in FIGS. **1**A and **1**B, more or fewer walking machines may be used to move loads **100**, **101**.

FIGS. **2**A-**2**F provide an overview of an example operation of walking apparatuses to move a load according to embodiments of the invention. Referring to FIG. **2**A, walking apparatuses **215** are positioned on a base surface **205** below or adjacent to a load **200**. Referring to FIG. **2**B, the walking apparatuses **215** are attached to the load **200**, and are positioned above a base surface **205**. As described below, there are many possible connection variations that can be used to connect the walking apparatuses to a load **200**. Referring to FIG. **2**C, the walking apparatuses **215** are operated so that a foot portion of the walking apparatus contacts the base surface **205**. The walking apparatuses **215** may be operated substantially simultaneously, or may be operated in intervals depending on the conditions of the base surface **205** and the load **200** that is to be moved.

Referring to FIG. **2**D, the walking apparatuses **215** are operated to lift the load **200** above the base surface **205**. The walking apparatuses **215** may again be operated substantially simultaneously to lift the load **200**, or may be operated in intervals depending on the conditions associated with the desired move.

Referring to FIG. **2**E, the walking apparatuses **215** are operated to move the load **200** to the right. Although FIG. **2**E shows the load **200** being moved to the right, the walking apparatuses can be operated to move the load in a variety of directions depending on the desired final location of the load. Referring to FIG. **2**F, the walking apparatuses **215** are operated to lower the load **200** to the base surface **205** and to raise the foot portions of the walking apparatuses above the base surface. That is, after the load **200** is positioned on the base surface **205**, the walking apparatuses **215** are further operated so that they are raised above the base surface. Here, the connection between the walking apparatuses **215** and the load **200** support the walking apparatuses **215** when they are raised above the base surface **205**. After the walking apparatuses **215** are raised above the base surface **205**, they are further operated to be repositioned for another movement walking step, such as by moving the foot portions of the walking apparatuses to the right so that they are in a position as shown in FIG. **2**B. That is, the base surface touching part of the walking apparatuses **215** (e.g., the support foot and related structures) is moved to the right while the walking apparatuses **215** are raised above the base surface **205**. After the walking apparatuses **215** have been repositioned, they are operated to be lowered to the base surface **205** as shown in FIG. **2**C. This completes a single walking cycle, and further walking cycles or steps can be performed by repeating the steps described above with respect to FIGS. **2**D to **2**F.

As mentioned above, walking apparatuses can be connected to loads in a variety of ways depending on the specific conditions surrounding the load. FIGS. **3**A and **3**B illustrate two such connection schemes. Although two connection schemes are illustrated in FIGS. **3**A and **3**B, embodiments of the invention are not limited to such connection schemes, as many different connection variations exist and are included in the scope of this concept.

Referring to FIG. **3**A, a walking apparatus **315** includes a support foot **340** to interface with a base surface **305** and a lift mechanism **320** to raise and lower a load **300**. In the embodiment shown in FIG. **3**A, the lift mechanism **320** of the walking apparatus **315** is attached to a connection frame **318**, which in turn is bolted to framework **310** supporting the load **300** with bolts **312** or other connection mechanisms. In some embodiments, the connection frame **318** may be part of the walking apparatus **315** and in some instances, may be permanently welded, bolted, or otherwise connected to the lift mechanism **320** of the walking apparatus. In other embodiments, the connection frame **318** may be separate from the walking apparatus **315**, and may only be temporarily used with the walking apparatus in certain situations. In these embodiments, for example, multiple different connection frames **318** may be built or used with specific load conditions or specifications.

FIG. **3**B shows different embodiments where the portions of a lift mechanism **320** of a walking apparatus **315** are directly connected to a support frame **310** structured to support a load. **300** with bolts **312** or other connection mechanisms. The support frame **310** may be considered part of the load **300** in some instances where it is a permanent part of the load structure. For example, in instances where the load is a silo, such as shown in FIG. **10**, the metal frame of the silo may be considered the support frame **310** of the load **300**, while also being part of the silo, and hence part of the load. In other cases, the support framework **310** may be an ancillary structure that is only used to stabilize and support the load **300** during movement of the load.

FIG. **4** is a schematic diagram illustrating movement of a load along a substantially linear path according to embodiments of the invention. Referring to FIG. **4**, load **400** is connected to multiple walking apparatuses **415**, which are used to move the load from an initial position X**1** to a final position X**2** along a substantially linear path. Here, that path is a horizontal path moving from left to right. This type of basis linear movement can be accomplished by a variety of walking systems.

FIG. **5** is a schematic diagram illustrating movement of a load along a curved path according to embodiments of the invention. Referring to FIG. **5**, a load **500** is connected to multiple walking apparatuses **515**, which are used to move the load from an initial position X**3** to a final position X**4** along a non-linear path. Here, a reference center-point **502** of the load **500** at the initial position X**3** is moved to a reference center-point **592** of the load **500** at the final position X**4**. Unlike the linear movement shown in FIG. **4**, this curved path of travel shown in FIG. **5** requires that the walking apparatuses be steered, which can be accomplished using embodiments of the inventive walking apparatuses described below.

FIG. **6** is a schematic diagram of a top view of a walking apparatus according to embodiments of the invention. Referring to FIG. **6**, a load transporting apparatus **615** is configured to move a load (e.g., element **100** FIG. **1**) over a base surface **605** in one or more incremental steps each including a load-movement phase and a recovery phase. The load transporting apparatus **615** includes a lift mechanism **620** structured to lift a load-bearing frame **610** supporting the load and a support foot **640** connected to the lift mechanism, the support foot structured to interface with the base surface **605**. A roller assembly **630** is also coupled to the lift mechanism **620**. A travel mechanism **660** is coupled to the roller assembly **620**, and is structured to displace the roller assembly relative to the support foot **640**. The load transporting apparatus also includes one or more linking devices **670** coupled to the support foot **640**, and one or more biasing devices **680** coupled to the linking devices. The biasing devices **680** are structured to become activated during a load-movement phase when the roller assembly **630** is non-linearly displaced by the travel mechanism **660** relative to the support foot **640**, and structured to return the support foot to an aligned position relative to the load-bearing frame **610** during a recovery phase. Here, the support foot **640** may be aligned with the load-bearing frame **610** when a longitudinal centerline of the support foot is parallel with a main beam of the load-beating frame.

In these embodiments, the linking devices **670** are coupled to the biasing device **680** so that when the roller assembly **630** moves the load in a direction different than the orientation of the support foot **640**, a deflection force is generated and/or stored as potential energy in the biasing device **680**. This deflection force may be stored by deforming the biasing device **680** within the elastic region of a stress-strain curve associated with a material of the biasing device. For example, in embodiments where the biasing device **680** is a torsional bar, the deflection force transmitted to the biasing device during the non-linear displacement or movement may cause the torsional bar to twist.

The contact between the support foot **640** and the base or ground surface **605** creates substantial frictional forces that prevent the support foot from rotating or moving during the non-linear displacement. During the recovery phase of the walking cycle, the support foot **640** is raised above the base surface **605**, which eliminates the frictional forces between the foot and the base surface. Once the support foot **640** begins to lose contact with the base surface **605**, the potential energy stored in the biasing device **680** is used to return the support foot to an aligned position relative to the load-bearing frame **610**. The alignment of the load-bearing frame **610** is dictated by the movement of the roller assembly **630** by the travel mechanism **660**. Hence, when the roller assembly **630** is non-linearly displaced (e.g., moved such as shown in FIG. **5**), the orientation of the load-bearing frame **610** becomes skewed from the orientation of the support foot **640**. In the above example, where the biasing device **680** is a torsional bar, the support foot **640** is returned to a positioned aligned relative to the load-bearing frame **610** when the support foot loses contact with the base surface **605** and the torsion bar is allowed to "untwist," thereby re-orienting the support foot. In other words, the torsion bar is activated when an angular displacement occurs between the support foot **640** and the load-bearing frame **610**, where the activation of the torsion bar including a torquing force being applied to the torsion bar.

Although a torsion bar is discussed as the biasing device **680**, may different types of biasing devices may be used in other embodiments, such as leaf springs, coil springs, chains, hydraulic cylinders, motors, or any other type of device that can be deflected and/or store potential energy to apply a realignment force to the support foot **640**.

FIG. **6** is presented in a schematic style view as many possible variations in the appearance and mechanical structure of the load transporting apparatus **615** exist. FIGS. **7**A and **7**B provide a more detailed view of one embodiment of a load transporting apparatus. FIG. **7**A is a side view of an example walking apparatus in a recovery position according to embodiments of the invention. FIG. **7**B is a side view of the example walking apparatus shown in FIG. **7**A in a load-movement position according to embodiments of the invention. Referring to FIGS. **7**A and **7**B, a load transporting or walking apparatus **715** includes a lift mechanism **720**, a roller assembly **730**, a roller track **750**, and a support foot **740**. The lift mechanism **720** may include a hydraulic jack suspended from a horizontal beam of the load-bearing frame **710**. Additional details regarding the structure of the load transporting apparatus **715** can be found in co-pending application Ser. No. 13/711,193, entitled ROTATION DEVICE FOR LOAD TRANSPORTING APPARATUS, the contents of which are herein incorporated by reference in their entirety.

The roller track **750** of the walking apparatus **715** may be coupled to the support foot **740** with a connection mechanism that allows the support foot to rotate relative to the roller track. Various connection mechanisms may be used to facilitate this relative rotation, such as a rotation pin described below in FIG. **9** and in the above mentioned application Ser. No. 13/711,193. In addition, the lift mechanism **720** may be structured to allow the roller assembly **730** to rotate about a substantially vertical axis in the center of a cylinder rod of the lift mechanism. That is, the roller assembly **730** may also be free to rotate around the cylinder rod of the lift mechanism **720**.

The walking apparatus **715** may also include a travel mechanism **760** that is connected to the roller track **750** and coupled to the roller assembly **730** such that when the travel mechanism is activated, the roller assembly moves relative to the roller track. In the embodiment shown in FIGS. **7**A and **7**B, the travel mechanism **760** includes two travel cylinders mounted on the roller track **750** on opposite sides of the roller track. Here, the travel cylinders of the travel mechanism **760** may balance the load being moved by the roller assembly **730** over the roller track **750**. In other embodiments, one travel cylinder, or three or more travel cylinders may be used to move the roller assembly **730** relative to the roller track **750**. In other embodiments, the travel mechanism **760** may include different movement structures, such as pulleys, levers, winches, tracks, etc.

In the embodiments shown in FIGS. **7**A and **7**B, the roller assembly **730** may include a plurality of rollers or roller chain that rotate as well as roll on the roller track **750**. That is, in some embodiments, the roller assembly **730** may include a WBOT series roller assembly from Hilman Rollers. Due to the configuration of the roller chain **730** of the roller assembly **730** and the tolerance between the roller assembly and the roller track **750** of the walking machine **715**, the rollers of the roller chain will typically be engaged with the roller track during operation and use of the walking machine.

The roller assembly **730** may be secured to the lower end of the lift mechanism **720**, with the roller assembly being captured within a U-shaped roller track **750**. The roller assembly **730** may be configured to roll along the bottom inside surface of the roller track **750** as well as along the underside of the two upper flanges of the roller track. The one or more travel cylinders **760** may be coupled between the lift mechanism **720** and the roller track **750**. Accordingly, as will be understood from the more detailed discussion below, these travel cylinders **760** permit for the translation of the roller track **750** relative to the lift mechanism **720** and vice versa. As discussed above, the roller track **750** may be secured to the elongate ground-engaging foot **740** (support foot) via a rotational pin (not shown in FIG. **7**, but similar to element **955** of FIG. **9**), which enables the roller track to be rotationally positioned relative to the foot for steering of the walking machine **715**.

As shown in FIGS. **7**A and **7**B, a linking mechanism **770** is coupled to the support foot **740** and a biasing device **780** (shown more clearly as element **880** in FIG. **8**A). In some embodiments, the linking mechanism **770** may include a first linking device attached at a first end of the support foot **740**, where a second linking device connected to a second end of the support foot opposite of the first end of the first support foot (such as shown in FIGS. **6** and **8**A). The biasing device **780** may be coupled between the first and second linking devices of the linking mechanism **770**.

In the embodiments shown in FIGS. **7**A and **7**B, the linking mechanism **770** includes a first linking rod **772** connected to the support foot **740** with a first pivot joint **771**. In some embodiments, the first pivot joint **771** may be a spherical rod end bearing configured to allow movement in three degrees of freedom. In other embodiments, the first pivot joint **771** may be another type of joint, such as a hinge joint, that restricts movement to one or two degrees of freedom.

The linking mechanism **770** may also include a second linking rod **774** connected to the first linking rod **772** with a second pivot joint **773**. As with the first pivot joint **771**, the second pivot joint **773** may be a spherical rod end bearing, or any other type of joint. The second linking rod **774** may further be connected to the load-bearing frame **710**. In other embodiments, the one or more biasing devices **780** are also coupled to the load-bearing frame **710**.

As shown in FIGS. **7**A and **7**B, the first and second pivot joints **771**, **773** allow linking mechanism **770** to move vertically with the support foot **740** without deflecting or otherwise activating the biasing device **780**.

As shown in co-pending application Ser. No. 13/711,315, entitled CENTERING DEVICE FOR LOAD TRANSPORTING APPARATUS, the contents of which is herein incorporated by reference in its entirety, a walking apparatus **715** may also include one or more guide devices positioned adjacent to the roller assembly **730**, and one or more biasing devices coupled to the guide devices. Here, the biasing devices may be structured to become deflected during a load-movement phase when the movement of the roller assembly **730** deviates from a set direction of travel, and structured to return the support foot to a centered position relative to the support foot **740** during a recovery phase.

FIGS. **8**A, **8**B, **8**C, and **8**D are side and top views of walking apparatuses that illustrate an example operation progression of a load transporting system according to embodiments of the invention. Here, FIGS. **8**A-**8**C may show a load-movement phase of a walking cycle, while FIG. **8**D may show a recovery phase of a walking cycle, where the walking apparatus is in a spin steering mode.

Referring to FIG. **8**A, a walking apparatus includes a support foot **840** positioned on abase surface **805** and connected to roller track **850**. The roller track **850** is structured to allow a roller assembly **830** to move relative to the roller track when activated by a travel mechanism **860**. A lift mechanism **820**, such as hydraulic jack, is connected between the roller assembly **830** and load-bearing frame **810**. A linking device **870** includes a first linking member **872** that is connected to the support foot, and a second linking member **874** that connects the first linking member to the load-bearing frame **810**. A biasing device **880** is also connected to the linking device **870**, and structured to become deflected or activated during a non-linear movement of the roller assembly **830** relative to the support foot **840**. As shown in FIG. **8**A, the walking apparatus **815** is in an initial position of a walking cycle in a spin steering mode. The roller tracks **850** of each walking apparatus **815** are oriented in a desired direction of travel. Here, in this first step of making a spin movement, the lift mechanisms **820** are activated to lift the load-bearing frame **810** (and load) above the base surface.

Referring to FIG. **8**B, a step in a walking motion of the walking machine is illustrated. Specifically, as indicated by the arrows showing rotation of the load-bearing frame **810**, the travel mechanism **860** is activated to displace the roller assembly **830** relative to the roller track **850** as shown. In this second step the walking system is moved in a circular or spin direction. Here, the travel cylinders of the travel mechanism **860** are actuated and the load-bearing frame **810** moves to a new angle. The support feet **840** are on the support surface and an angle of displacement occurs between the load-bearing frame **810** and the support feet. This non-linear movement or angular displacement causes an angular change in the biasing device **880**. In embodiments where the biasing device **880** is a torsion bar, the resulting torque on the torsion bar causes the part of the linking device **870** to be in compression and causes another part of the linking device to be in tension.

Referring to FIG. **8**C, the travel mechanism **860** has finished moving the roller assembly **830** and load-bearing frame **810**. Additionally, the lift mechanism **820** has been activated to lower the load and load-bearing frame **810**. Here, the load-bearing frame **810** has just contacted the ground surface. However, the support foot **840** is still positioned on the ground surface as well. Hence, the biasing devices **880** are still in a deflected, activated, or biased state.

Referring to FIG. **8**D, the lift mechanism **820** is continued to be operated such that the support foot **840** loses contact with the ground surface. As soon as this connection between the support foot **840** and the ground surface disappears, the biasing device **880** causes the support foot to "snap" back into alignment with the load-bearing frame **810** as shown.

FIGS. **9**A-**9**C illustrate another embodiment of a walking apparatus. Here, FIG. **9**A is a top view of a walking apparatus in a perpendicular orientation according to embodiments of the invention, FIG. **9**B is a side view of the walking apparatus shown in FIG. **9**A in a load-movement position where the linking devices have been removed for clarity sake. FIG. **9**C is a side view of the walking apparatus shown in FIG. **9**A in a recovery position with the linking devices added back in for reference purposes.

Referring to FIGS. **9**A-**9**C, a walking apparatus **915** includes a lift mechanism **920** coupled to a load-bearing frame **910** that supports a load to be moved. The lift mechanism **920** is connected to a roller assembly **930** that is positioned on a roller track **950**. The roller assembly **930** is moved relative to the roller track **950** with one or more travel mechanisms **960**. The roller track **950** is coupled to a support foot **940** with a rotation pin **955**, such as a king pin or other connection means that allows rotation of the roller track relative to the support foot as described in the rotation device application (Ser. No. 13/711,193) cited above. A linking device **970** is coupled between the support foot **940** and the load-bearing frame **910**. A biasing device **980** is connected to the linking device **970**, As described above, the biasing device **980** becomes deflected or activated when the roller assembly **930** moves in a non-linear direction relative to the support foot **940**. For example, the roller track **950** is oriented perpendicular to the orientation of the support foot **940** in FIG. **9**A. As the roller assembly **930** moves in the direction of the orientation of the roller track **950**, the roller assembly and the load-bearing frame will also move substantially perpendicularly to the orientation of the support foot **940**.

Here, the movement of the roller assembly **930** in this orientation does not activate or deflect the biasing device **980** because the linking devices **970** include joints that allow for the free movement of the roller assembly. The linking devices **970** may be structured in this manner because the orientation of the support foot **940** relative to the load-bearing frame **910** does not change.

This can also be seen when the roller assembly is moved parallel to the orientation direction of the support foot, as shown in FIG. **10**. Referring to FIG. **10**, a walking apparatus **1015** has just completed a load-movement phase of a walking cycle where a roller track **1050** is oriented in the same direction as a support foot **1040**. Here, the roller assembly **1030** was moved to the right, along with the load-bearing frame **1010**, as shown. The joints of the linking device **1070**, however, allow the linking device to be angled from the linear movement without deflecting or otherwise activating the biasing device **1080**. During a recovery phase, the load-bearing frame **1010** is lowered and the support foot **1040** is raised above a base surface. The support foot **1040** can then be repositioned relative to the roller assembly **1030** by activation of the transport mechanism **960** (FIG. **9**B).

Some of the embodiments discussed above rely on the load-bearing frame as a reference point to realign the support feet during non-linear movements of the load. However, in other embodiments, other linking and biasing devices can be utilized to maintain alignment of the support feet. Some of these techniques are discussed below with respect to FIGS. **11** and **12**A-**12**E.

FIG. **11** is a top view of a load movement system according to embodiments of the invention. Referring to FIG. **11**, multiple load transporting apparatuses **1115**,**1116**, **1117**, **1118** are used to move a load supported by a load-bearing frame **1110**. Each of these load transporting apparatuses **1115**,**1116**, **1117**, **1118** include a roller track **1150**, a roller assembly **1130** that moves relative to the roller track, and a support foot **1140**. Here, load transporting apparatuses that are in orientation-rows are connected with one or more biasing devices **1182**, **1184**. In particular, the support foot **1140** of a first load transporting apparatus **1115** is connected to the support foot of a second load transporting apparatus **1116** with two biasing devices **1182**A and **1182**B. These biasing devices **1182**A, **1182**B ensure that the first and second load transporting apparatuses **1115**, **1116** are maintained in alignment with one another and the load-bearing frame **1110**.

Here, the linking devices include a first linking device **1182**A coupled between a first side of a first end of the first support foot **1140** and a first side of a first end of the second support foot **1140**, and a second linking device **1182**B coupled between a second side of the first end of the first support foot and a second side of the first end of the second support foot. The placement of the first and second linking devices **1182**A, **1182**B may ensure that the support feet **1140** are aligned together during a non-linear movement.

Similarly, the support foot **1140** of a third load transporting apparatus **1117** is connected to the support foot of a fourth load transporting apparatus **1118** with two biasing devices **1184**A and **1184**B. These biasing devices **1184**A, **1184**B ensure that the third and fourth load transporting apparatuses **1117**, **1118** are maintained in alignment with one another and the load-bearing frame **1110**.

Although FIG. **11** illustrates one example embodiment of biasing device connections that can maintain alignment of a support foot relative to a load-bearing frame, many different configuration variations exist. FIGS. **12**A, **12**B, **1**C, **12**D, and **12**E are diagrams of walking apparatuses with various alignment restoration devices that illustrate some of these variations according to embodiments of the invention.

Referring to FIG. **12**A, a linking device **1271** is connected between a first support foot **1240** of a first load transporting apparatus **1215** and a second support foot **1241** of a second load transporting apparatus **1216**. The linking device **1271** may be attached to the first support foot **1240** with a first joint **1291**, and may be attached to the second support foot **1241** with a second joint **1292**. In some embodiments, the first and second joints **1291**, **1292** may be ball joints that allow rotational movement. The linking device **1271** may be rigid rod, or may include a section of chain.

Referring to FIG. **12**B, a linking device **1272** is connected between a first support foot **1240** of a first load transporting apparatus **1215** and a second support foot **1241** of a second load transporting apparatus **1216**. The linking device **1272** may be rigidly attached to the first support foot **1240**, but may be attached to the second support foot **1241** with a first biasing device **1281** and a second biasing device **1282**. The first and second biasing devices **1281**, **1282** may be placed on opposite sides of the linking device **1272** to provide a balanced system to return the support feet **1240**, **1241** to uniform alignment after a non-linear movement.

Referring to FIG. **12**C, a first biasing device **1283** and a second biasing device **1284** are connected between a first support foot **1240** of a first load transporting apparatus **1215** and a second support foot **1241** of a second load transporting apparatus **1216**. This embodiment may be similar to the shown in FIG. **11**, except that the first and second biasing devices **1283**, **1284** are specified as spring devices.

Referring to FIG. **12**D, the support foot **1240** of a load transporting apparatus **1215** is connected to a load-bearing frame **1210** via a first linking cylinder **1273** and a second linking cylinder **1274**. The first and second linking cylinders **1273**, **1274** may be hydraulic cylinders that are activated during a recovery phase of a walking cycle to return the support foot **1240** to alignment with the load-bearing frame **1210**. Alternatively, the first and second linking cylinders **1273**, **1274** may be spring cylinders that automatically return the support foot **1240** to alignment with the load-bearing frame **1210** during a recovery phase of a walking cycle without additional operator input.

Referring to FIG. **12**E, a support foot **1240** of a load transporting apparatus **1215** is connected at each corner to a biasing device **1285**, **1286**, **1287**, **1288**. These biasing devices **1285**, **1286**, **1287**, **1288** may ensure that the support foot **1240** is maintained in alignment with a load-bearing frame during the recovery phase of a walking cycle by releasing potential energy stored during compression and/or elongation during non-linear movements.

FIG. **13** is a flow diagram illustrating method of operating a load transporting apparatus according to embodiments of the invention. In particular, the flow diagram of FIG. **13** illustrates a method of aligning a support foot of a load transporting device relative to a load-bearing frame during a load-transporting movement. The load transporting device includes a roller assembly coupled to a lift mechanism, a travel mechanism structured to displace the roller assembly relative to the support foot, one or more linking devices coupled to the support foot, and one or more biasing devices coupled to the linking devices.

Referring to FIG. **13**, a flow begins at process **1305** where the lift mechanism is activated to lower the support foot to aground surface and raising a load supported by the load-bearing frame. In process **1310**, the travel mechanism is activated to displace the roller assembly connected to the lift mechanism relative to the support foot and ground surface, thereby moving a position of the load. Depending on the movement of the travel mechanism relative to the support foot, the position of the support foot may be aligned with the load-bearing frame or may not be aligned with the load-bearing frame. As discussed above, when the load is moved in a direction perpendicular to the orientation of the support foot, or moved parallel to the orientation of the support foot, the support foot typically remains aligned with the load-bearing-frame. If the load is moved in a different direction relative to the support foot, such as when the load is being steered in a non-linear path, the support foot can become misaligned with the load-bearing frame. In process **1315**, it is observed whether the resulting position of the support foot is aligned with the load-bearing frame.

When the support foot remains aligned with the load-bearing frame, the flow proceeds to process **1320** where the lift mechanism is activated to lower the load and raise the support foot. However, when the support foot is not aligned with load-bearing frame, the biasing device is deflected via the linking device as the load is displaced as shown in step **1325**. That is, the biasing devices are deflected when movement of the roller assembly results in an angular displacement between a centerline of the support foot and an orientation of the load-bearing frame. In process **1330**, the lift mechanism is activated to lower the load and raise the support foot from the ground surface. As the support foot loses contact with the ground surface, the deflected biasing device acts on the support foot to align the support foot with the load-bearing frame, as shown in step **1335**. That is, the centerline of the support foot is automatically aligned relative to the orientation of the load-bearing frame. After step **1335** or process **1320**, the flow may include optional process **1340** where the lift mechanism is repositioned with respect to the support foot. If further walking steps are needed to move the load to a final position, the flow may return to process **1305** to initiate another walking cycle.

As described above, some embodiments of this invention are directed to a load transporting apparatus configured to move a load over a ground surface in one or more incremental steps each including a load-movement phase and a recovery phase. To move the load, the load transporting apparatus is coupled to a load-bearing frame configured to support the load. The load transporting apparatus includes a first support foot structured to interface with the ground surface, the first support foot having a length, width, and longitudinal centerline bisecting the width of the first support foot. The load transporting apparatus also includes a second support foot structured to interface with the ground surface, the second support foot also having a length, width, and longitudinal centerline bisecting the width of the second support foot.

First and second roller tracks are respectively coupled to the first support foot and second support foot via a first king pin connector and a second king pin connector. Additionally, first and second roller assemblies are respectively positioned on the first and second roller tracks. Each roller assembly includes a roller frame and one or more rollers set in the roller frame. First and second lift mechanisms are respectively coupled to the first and second roller assemblies. Each of the first and second lift mechanisms includes a lift cylinder connected to the load-bearing frame, and a cylinder rod, where each of the first and second lift mechanisms are structured to lift the load-bearing frame at the start of the load-movement phase.

The load transporting apparatus also includes first and second travel mechanisms respectively coupled to the first and second roller assemblies, Each of the travel mechanisms are structured to move the respective roller assembly relative to the respective support foot during the load-movement phase. A first linking device coupled to the first support foot, and a second linking device coupled to the second foot. A first biasing device is connected to the first linking device, where the first biasing device is structured to become activated during aloud-movement phase when the first roller assembly is non-linearly displaced by the first travel mechanism relative to the first support foot, and structured to return the first support foot to an aligned position relative to the load-bearing frame during a recovery phase. A second biasing device is connected to the second linking device, where the second biasing device is structured to become activated during a load-movement phase when the second roller assembly is non-linearly displaced by the second travel mechanism relative to the second support foot, and structured to return the second support foot to an aligned position relative to the load-bearing frame during a recovery phase.

In some embodiments, the first linking device is coupled between the first support foot and the second support foot. In these embodiments, the second linking device is also coupled between the first support foot and the second support foot, as shown in FIG. **11**, for example. In other embodiments, the first and second biasing devices are respectively coupled to the load-bearing frame, such as in FIG. **7**A, for example.

FIG. **14** illustrates an example mounting structure **1400** such as may be used to support an oil rig. Mounting structure **1400** may comprise a rig platform **1460** connected to abuse **1480** by one or more rear legs such as first leg **1470** and one or more front legs, such as second leg **1490**. Rig platform **1460** may comprise a rig support structure **1450** configured to support a mast, a drill, traveling blocks, and other components associated with a rig or other type of heavy load supported by mounting structure **1400**.

In some examples, mounting structure **1400** may be placed over a well head such that a well head centerline **1405** of mounting structure **1400** may be located between first leg **1470** and second leg **1490**, Additionally, the rig platform **1460** may be connected to the base **1480** by one or more struts, such as rear transport strut **1415** and/or front transport strut **1425**, and one or more hydraulic cylinders, such as hydraulic cylinder **1840**. Hydraulic cylinder **1840** may comprise a telescoping hydraulic cylinder. Additionally, one or more telescoping struts, such as diagonal strut **1440**, may be configured to provide additional support of mounting structure **1400**.

Mounting structure **1400** may comprise a walking system including a number of transport systems **1410**, **1420** configured to position or move mounting structure **1400** over the well head. In some examples, transport systems **1410**, **1420** may comprise one or more of the transportation devices and/or systems described in U.S. Pat. No. 8,573,334, U.S. Pat. No. 8,561,733, and U.S. Pat. No. 8,490,724, or any combination thereof.

In some examples, transport struts **1415**, **1425** may be configured to primarily provide structural support while transport systems **1410**, **1420** are moving mounting structure **1400** and a rig and/or load supported by mounting structure **1400**. In some examples, one or both of transport struts **1415**, **1425** may be oriented at a diagonal angle in order to offset or redistribute the weight of the load. For example, front transport strut **1425** may be configured to provide an offset load bearing path from rig platform **1460** to transportation device **1420** located outside of, and/or in front of, base **1480**.

Base **1480** may be configured to support the weight of mounting structure **1400** during operation of a rig, in which case base may be in contact with the ground or other surface upon which mounting structure **1400** is located. In some examples, transportation devices **1410**, **1420** may be configured to lift base **140** and/or the entire mounting structure **1400** off the ground, such as when the rig is being moved from one well head to another well head. A first set of one or more transport devices, such as transport device **140**, may be configured to lift approximately half of the weight of mounting structure **1400** at a first load bearing position **1455**. A second set of one or more transport devices, such as transport device **1420**, may be configured to lift approximately half of the weight of mounting structure **1400** at a second load bearing position **1475**. In some examples, more than two load bearing positions may be used to lift and/or move mounting structure **1400**.

FIG. **15** illustrates a bottom view of a mounting structure **1500** which may be configured similarly as mounting structure **1400** of FIG. **14**. Mounting structure **1500** may comprise one or more struts, such as struts **1570** and **1590**, connecting a left side base **1581** of mounting structure **1500** with a right side base **1582** of mounting structure **1500**. A first set of transportation devices comprising a first rear transport device **1511** and a second rear transport device **1512** may be associated with a first load bearing position **1550**. Additionally, a second set of transportation devices comprising a first front transport device **1521** and a second front transport device **1522** may be associated with a second load bearing position **1575**.

During operation of a rig associated with mounting structure **1500**, a well head **1525** may be located between first load bearing position **1550** and second load bearing position **1575**. For example, well head **1525** may be located at the intersection formed by well head centerline **1505** and a longitudinal centerline **1505** of mounting structure **1500**.

First rear transport device **1511** and second rear transport device **1512** are illustrated as being located within left side base **1581** and right side base **1582**, respectively. Locating one or more transportation devices within the base framework may provide lateral clearance when mounting structure **1500** travels over the well head **1525**, such that the well head **1525** and associated casing, valving, etc. pass between left side base **1581** and right side base **1582**.

FIG. **16** illustrates an enlarged partial view of a mounting structure **1600** comprising a first transportation system, such as transport system **1410** of FIG. **14**. First transport system **1410** may comprise a transport support **1620**, abuse connection **1630**, and/or a transportation device **1610**. Transport support **1620** may be configured to connect strut **1415** to base **1480**. Transport support **1620** may be connected to base **1480** via base connection **1630**. In some examples, transport support **1620** may comprise one or more bolts, pins, rods, hooks, clamps, latches, other types of connection devices, or any combination thereof.

Strut **1415** may be connected to transport support **1620** at a first end **1640** of strut **1415**. Additionally, strut **1415** may be connected to rig platform **1460** at a second end **1645** of strut **1415**. In some examples, strut **1415** may be configured to diagonally connect rig platform **1460** to base **1480** at a point located above transportation device **1610**. When mounting structure **1600** is at rest with base **1480** in contact with the ground or operating surface, the weight of the associated drill and/or load located on rig platform **1460** may be primarily borne by first leg **1470**. First leg **1470** may be positioned directly below one or more support legs of rig support structure **1450**.

Strut **1415** may be configured to transfer at least a portion of the weight of the drill and/or load (along with a portion of the overall weight of mounting structure **1600**) from first leg **1470** to first load bearing position **1455** when mounting structure **1600** is in a raised position on transportation device **1610**, e.g., when base **1480** is lifted off the ground.

One or more transportation devices; such as transportation device **1610**, may be configured to raise and lower the entire mounting structure **1600** during operation of the drill, e.g. to move the drill relatively short distances from one well head centerline **1405** to another well head. However in some examples, mounting structure **1600** may be moved relatively large distances, such as from a first drilling site to another drilling site, which may be located many miles distant from each other, in which case it may be impractical to rely on transportation device **1610** to provide the sole means for transportation.

Mounting structure **1600** may be configured to be placed into a compact state for distant transportation. In some examples, one or more hydraulic cylinders, such as hydraulic cylinder **1840**, may be configured to raise and/or lower rig platform **1460** with respect to base **1480**. In preparation for, or in the process of, lowering mounting structure **1600** into the compact state, strut **1415** may be disconnected from one or both of base **1480** and rig platform **1460**. In some examples, first end **1640** of strut **1415** may be disconnected from transport support **1620**.

Strut **1415** may be rotated to an approximately horizontal transport/storage position **1615**B, shown in dashed lines. Being connected to transport support **1620** at a raised elevation with respect to base **1480**, first end **1640** of strut **1415** may rotate along an arc **1685** with sufficient clearance to avoid contact with base **1480** as strut **1415** is rotated into transport/storage position **1615**B. The lower portion of first leg **1470** may be pivotably connected to base **1480** at a pivoting connection **1472**.

FIG. **17** illustrates an enlarged partial view of a mounting structure **1700** comprising a second transport system, such as transport system **1420** of FIG. **14**. Second transport system **1420** may comprise a transport support **1720** and/or a transportation device **1730**. Transportation device **1730** may comprise a hydraulic device **1740** configured to lift, lower, move, and/or rotate transportation device **1730** with respect to transport support **1720**.

Transport support **1720** may be configured to connect strut **1425** to base **1480**. In some examples, strut **1425** may be connected to transport support **1720** at a point above transportation device **1730**. Additionally, transport support **1720** may be connected to base **1480** at a connection point **1765**. In some examples, connection point **1765** may provide for a pivot point about which at least a portion of second transport system **1420** may rotate and/or be raised. Transportation device **1730** may be located in front of rig platform **1460** and/or in front of base **1480**.

Strut **1425** may be connected to transport support **1720** at a first end **1745** of strut **1425**. Additionally, strut **1425** may be connected to rig platform **1460** at a second end **1755** of strut **1425**. In some examples, strut **1425** may be configured to diagonally connect rig platform **1460** to transport support **1720** at the point located above transportation device **1730**. When mounting structure **1700** is at rest with base **1480** in contact with the ground or operating surface, the weight of the associated drill and/or load located on rig platform **1460** may be primarily borne by second leg **1490**. In some examples, second leg **1490** may be positioned directly below one or more support legs of rig support structure **1450** (FIG. **14**).

Strut **1425** may be configured to transfer at least a portion of the weight of the drill and/or load (along with a portion of the overall weight of mounting structure **1700**) from second leg **1490** to second load bearing position **1475** when mounting structure **1700** is in a raised position on transportation device **1730**, e.g., when base **1480** is lifted off the ground.

One or more transportation devices, such as transportation device **1730**, may be configured to raise and lower the entire mounting structure **1700** during operation of the drill, e.g. to move the drill relatively short distances from one well head centerline to another. Additionally, mounting structure **1600** may be configured to be placed into a compact state for distant transportation. Strut **1425** may be rotated about second end **1855** towards a transport/storage position **1825**A, shown in dashed lines, Being connected to transport support **1820** at a raised elevation with respect to base **1480**, first end **1845** of strut **1425** may rotate with sufficient clearance to avoid contact with base **1480** as strut **1425** is rotated into transport/storage position **1825**A.

FIG. **18**A illustrates a first portion of the mounting structure **1400** of FIG. **14** in a partially collapsed transport position, in which strut **1415** is shown in an approximately horizontal storage position. Strut **1415** may comprise a latch point **1660** configured to lift and/or securely connect strut **1415** to rig platform **1460**. In some examples, a cable **1675** may extend between latch point **1660** and a lifting mechanism **1680** attached to rig platform **1460** to facilitate the rotation of strut **1415** into the horizontal transport/storage position.

The rig platform **1460** is shown as having been lowered to a partially collapsed height **1825** with respect to base **1480**. Hydraulic cylinder **1840** is shown in a partially extended position as first leg **1470** pivots rig platform **1460** downward, causing a rig centerline **1805** associated with rig platform **1460** to move away from, e.g., to the left **1875** of well head centerline **1405** (FIG. **14**). In some examples, the rig and/or load may be removed from mounting structure **1400** prior lowering rig platform **1460**, such that the overall height **1860** of mounting structure **1400** may be associated with rig support structure **1450**.

A push-pull rod **1850** or connecting member may operatively connect transport support **1620** of first transport system **1410** to first leg **1470**. Push-pull rod **1850** may be rotatably connected to first leg **1470** at a pivoting connection **1855** and may be configured to push and/or pull at least a portion of first transport system **1410** in response to the rotation of first leg **1470** about pivoting connection **1472**. In some examples, push-pull rod **1850** may be configured to push transport support **1620** and/or transportation device **1610** away from well head centerline **1405** in a substantially lateral direction **1815**. At least a portion of first transport system **1410**, such as transport support **1620** and/or transport device **1610**, may be moved away from first load bearing position **1455** in response to lowering rig platform **1460**. Push-pull rod **1850** may push transport support **1620** in the lateral direction **1815** as first leg **1470** pivots about pivoting connection **1472** with respect to base **1480**. In some examples, transport support **1620** may be moved in the lateral direction **1815** after being disconnected from strut **1415**.

FIG. **18**B illustrates a second portion of the mounting structure **1400** of FIG. **14** in a partially collapsed transport/storage position. At least a portion of second transport system **1420**, such as transport support **1820** and/or transport device **1830**, may be moved away from second load bearing position **1475** in response to lowering rig platform **1460** towards base **1480**. In some examples, as rig platform **1460** is being lowered to the partially collapsed transport position, strut **1425**, or another connecting member, may be configured to lift and/or rotate at least a portion of second transport system **1420** about connection point **1865**. In some examples, one or both of first end **1845** and second end **1855** of strut **1425** may be configured to allow strut **1425** to pivot with respect to rig platform **1460** and transport support **1820**, respectively.

FIG. **19** illustrates the mounting structure **1400** of FIG. **14** in a fully collapsed transport/storage position. Both strut **1415** and strut **1425** are shown in a substantially horizontal transport/storage position, and hydraulic cylinder **1840** is shown in a retracted position. The rig platform **1460** is shown as having been lowered to a collapsed height **1925** with respect to base **1480**. Rig centerline **1805** associated with rig platform **1460** has moved away from well head centerline **1405**, such that substantially the entire rig platform **1460** is positioned to the left of well head centerline **1405**.

At least a portion of transport system **1410** has also been laterally moved away from first load bearing position **1455** in response to lowering rig platform **1460**, such that first transport system **1410** and/or second transport system **1420** does not interfere with the reduced overhead clearance associated with one or more struts, cylinders, or legs, such as first leg **1470**, in the fully collapsed transport position of mounting structure **1400**. Additionally, at least a portion of second transport system **1420** may be rotated and/or raised in response to lowering rig platform **1460** such that second transport system **1420** is no longer in contact with the ground and/or surface **1910**. In some examples, an upper portion of second transport system **1420** may be rotated and/or moved independent of a lower portion of second transport system **1420**.

By rotating second transport system **1420**, the length of mounting structure **1400** may be reduced. In some examples, the overall length of mounting structure **1400** in the fully collapsed transport/storage position may be equal to, or approximate, the length of base **1480**.

FIG. **20** illustrates a mounting structure **2000**, including an example transport system **2050** in an alternative transport/storage position. A first end **2045** of a strut **2025** is shown disconnected from a transport support **2020** of transport system **2050**, such that transport support **2020** and a corresponding transport device **2030** may remain adjacent to base **1480**, e.g., on the ground, with rig platform in the fully collapsed transport/storage position. Rig platform **1460** is shown moved to off to one side of well head centerline **105** and an overall height **2015** of mounting structure **2000** may determined for the highest point of the rig and/or rig support structure **1550** in the fully collapsed position.

Transport support **2020** may comprise a lift point **2010** configured to provide means for lifting and/or rotating at least a portion of transport system **2050**. Lift point **2010** may be fitted with a cable and a hoist may be used to lift or rotate transport support **2020** and/or transport device **2030** off the ground. In some examples, transport support **2020** may be disconnected from base **1480** at a connection point **2065**, such that at least a portion of transport system **0250** may be separately transported and/or stored from mounting structure **0200**. In still other examples, transport system **0250** may be placed on base **1480** or on rig platform **1460** during transport and/or during storage of mounting structure **2000**.

One or more support braces **2034** may be configured to support the weight of rig platform **1460** in the fully collapsed transport/storage position. Additionally, the one or more support braces **2034** may be configured to maintain clearance between transport system **2050** and/or transport systems **1410**, **1420** (FIG. **19**) and one or more struts, cylinders, or legs, such as first leg **1470** and strut **1415**, with mounting structure **2000** in the fully collapsed transport/storage position.

FIG. **21** illustrates an example support structure **2100** in a first mode of operation. The first mode of operation may be associated with operation of support structure **2100** during a drilling operation or during a rig walking operation. During the first mode of operation, the bottom of a base **2120** may be in contact with the ground or other surface **2128** upon which support structure **2100** may be placed on.

An upper portion **2110** of a transport system may be mounted to base **2120**. In some examples, upper portion **2110** may comprise a number of mounting devices **2112**, **2114** or holes through which one or more bolts, pins, rods, hooks, clamps, latches, or other types of connection devices may be used to mount upper portion **2110** to base **2120**. Additionally, upper portion **2110** may comprise a connection device **2115** for connecting to a strut or other type of support member, such as strut **1415** (FIG. **14**). Support structure **2110** may be connected to a push-pull device **2180**, or connecting member, shown in a retracted position. Push-pull device **2180** may comprise a hydraulic cylinder, a jack, a piston, a gear, a winch, a roller, a track, other types of pushing devices or pulling devices such as push-pull rod **1850** (FIG. **18**A), or any combination thereof. In some examples, push-pull device **2180** may be connected to support structure **2110** at a first end of push-pull device **2180** and may be connected to base **2120** at a second end of push-pull device **2180**.

The transport system associated with support structure **2100** may be approximately centered about a load bearing path **2150**. In some examples, a transport device **2130** may be configured to lift base **2120** along load bearing path **2150**. Upper portion **2110** may be configured as a transport support, e.g., to operably connect transport device **2130** to base **2120**. Additionally, upper portion **2110** may be configured to transfer the weight of a load supported by base **2120** onto the transport device **2130**. In some examples, upper portion **2110** may be configured to transfer or offset the effective weight of the load onto the load bearing path **2150** that passes through transport device **2130**.

Base **2120** may comprise a connecting structure **2125**, which may be configured as a substantial) horizontal plate. In some examples upper portion **2110** may be located above and/or on top of connecting structure **2125**, such that mounting devices **2112**, **2114** may attach to an upper portion of base **2120**. Connecting structure **2125** may be located at an approximate vertical mid-point of base **2120**. In some examples, connecting structure **2125** may be used to help locate upper portion **2110** with respect to base **2120**. Additionally, connecting structure **2125** may provide vertical support of the weight that is transferred from upper portion **2110** to the load bearing path **2150** associated with transport device **2130**.

FIG. **22** illustrates the example support structure **2100** of FIG. **21** in a second mode of operation, in which upper portion **2110** has been moved in a lateral direction **2225** away from load bearing path **2150**. Upper portion **2110** may be moved far enough in the lateral direction **2225** to provide a lateral clearance **2235** with load bearing path **2150**. The second mode of operation may be associated with the storage and/or long distance transport of support structure **2100**.

A number of receiving devices **2212**, **2214** may be located in base **2120**. Receiving devices **2212**, **2214** may comprise through-holes which correspond in number and relative position with mounting devices **2112**, **2114** of upper portion **2110**. For example, a first pin or bolt may be placed through corresponding holes associated with mounting device **2112** and receiving device **2212** with support structure configured in the first mode of operation (FIG. **21**), and a second pin or bolt may be placed through corresponding holes associated with mounting device **2114** and receiving device **2214** in the first mode of operation.

The first pin and/or second pin may be configured to impede movement of upper portion **2110** in the lateral direction **2225**. The pins/bolts may be removed so that upper portion **810** is allowed to move in the lateral direction **2225** during the second mode of operation. Upper portion **2110** may be configured to slide along connecting structure **2125**. In some examples, some or all of transport device **2130** may also move in the lateral direction **2225** together with upper portion **2110**.

Connection device **2115** may be disconnected from a strut or other type of support member prior to upper portion **2110** being moved in the lateral direction **2225**. In other examples, the push-pull device **2180**, shown in an extended position, may be configured to push and/or pull upper portion **2110** in the lateral direction **2225**.

FIG. **23** illustrates a further example support structure **2300** including the base **2120** and upper portion **2110** of FIG. **22** shown in a cross-sectional view. Base **2120** may comprise a first base plate **2121** and a second base plate **2122** connected by connecting structure **2125**. One or more holes, such as through-hole **2322**, may penetrate through one or both of first base plate **2121** and second base plate **2122**. Additionally, upper portion **2110** may comprise one or more holes such as through-hole **2312**. A connection device **2310** is shown in a partially withdrawn position **2325** and extending outside of a hole in first base plate **2121**. Connection device **2310** may comprise a bolt, pin, rod, hook, clamp, latch, other types of connection device, or any combination thereof, that may be inserted through upper portion **2110** and base **2120** via one or more through-holes **2312**, **2322**.

Upper portion **2110** may be positioned directly above a transport device **2330** configured to lift and/or rotate base **2120**. In some examples, a rotation/translation device **2335** may be configured to rotate and/or translate transport device **2330** within the base frame defined by first base plate **2121** and second base plate **2122**. First base plate **2121** and second base plate **2122** may rest on the ground or surface **2350** when base **2120** is not being lifted by transport device **2330**.

One or more rollers **2320** may be placed between a contact surface **2118** of upper portion **2110** and connecting structure **2125** to facilitate moving or rolling upper portion **2110** with respect to base **2120**. In some examples, connection device **2310** may be removed entirely from through holes **2312**, **2322** and used as a roller between contact surface **2118** and connecting structure **2125**. In other examples, upper portion **2110** may be configured to slide via direct contact between contact surface **2118** and connecting structure **2125** without the use of any rollers, Connection device **2115** may be disconnected from a strut or other type of support member prior to upper portion **2110** being moved on the one or more rollers **2320**. In other examples, a push-pull device attached to connection device **2115** may be configured to push and/or pull upper portion **2110**.

FIG. **24** illustrates a further example support structure **2400** in a transport/storage position. In some examples, substantially the entire support structure **2400** including an upper portion **2410** of support structure **2400** and a corresponding transport device **2430** may be moved in a lateral direction **2425** away from aloud bearing path **2450**. Transport device **2430** may be mounted, bolted, welded, or otherwise connected to upper portion **2410**. Upper portion **2410** may be moved far enough in the lateral direction **2425** to provide a lateral clearance **2435** with load bearing path **2450**. Similarly, transport device **2430** may be moved away from load bearing path **2450**.

Upper portion **2410** may be configured to slide, roll, or otherwise move along one or more surfaces or rails of a base structure **2420**. Additionally, transport device **2430** may be configured to slide, roll, or otherwise move along the ground or surface **2350** in the lateral direction **2425**. In some examples, support structure **2400** may comprise a hydraulic cylinder or other device configured to lift transport device **2430** off of the ground or surface **2350**. Transport device **2430** may be moved in the lateral direction **2425** in a raised position.

A push-pull device **2480** or connecting member, shown in an extended position, may be connected to one or both of upper portion **2410** of support structure **2400** and transport device **2430**. In sonic examples, push-pull device **2480** may comprise similar structural features, or be configured similarly, as push-pull device **2180** (FIG. **21**).

When support structure **2300** is located in the transport/storage position, it may be operably disconnected from base structure **2320** such that support structure **2300** may no longer be configured to provide a lifting function of base structure **2320** and/or of an associated rig that may be mounted to base structure **2320**. After the rig has been moved to a new location, support structure **2300** may be moved back to an operational position, e.g., with a centerline of transport device **2330** approximately aligned with load bearing path **2350**, so that support structure **2300** may again be configured to provide the lifting function.

FIG. **25** illustrates yet another example support structure **2500** comprising an upper portion **2510** of a transport system configured to rotate about a pivot point **2512**. Pivot point **2512** may comprise a bolt, a pin, a rod, or other type or pivot point configured to pivotably connect upper portion **2510** with a base **2520**. In some examples, upper portion **2510** may be configured to mount to base **2520** at both pivot point **2512** and at connection point **2514**. Connection point **2514** may align with a receiving point **2524** on base in a first mode of operation associated with transport device **2530**, and a pin, rod, hook, clamp, latch, other types of connection device, or any combination thereof, may be used to attach connection point **2514** with receiving point **2524**.

Connection point **2514** is shown in a rotated position **2525**, e.g., during a second mode of operation, up and away from receiving point **2524**, such that a lateral clearance **2535** is formed between upper portion **2510** and a load bearing path **2535** associated with transport device **2530**. The second mode of operation may be associated with storage and/or a long distance transport operation of base **2520**.

A connection device located at connection point **2514** and/or at receiving point **2524** may be removed to allow connection point **2514** to pivot to the rotated position **2525**. On the other hand, upper portion **2510** may be rotated while a second connection device remains connected at pivot point **2512**.

In some examples, upper portion **2510** may be rotated and/or moved to rotated position **1225** independent of any movement of transport device **2530**. In other examples, the rotation of upper portion **2510** may cause some or all of transport device **2530** to also rotate.

FIG. **26** illustrates yet another example support structure **2600** in a transport/storage position. Substantially the entire support structure **2600** including an upper portion **2610** of support structure **2600** and a corresponding transport device **2630** of support structure **2600** may be moved in a rotational direction **2625** about a rotational axis **2612**, such that transport device **2630** may be lifted off of the ground or surface **2350**. In some examples, transport device **2630** may be rotated from an approximately horizontal orientation associated with a lifting function, to a substantially vertical orientation associated with the transport/storage position. Transport device **2630** may be mounted, bolted, welded, or otherwise connected to upper portion **2610**.

A push-pull device **2680**, shown in a retracted position, may be connected to one or both of upper portion **2610** of support structure **2600** and transport device **2630**, In some examples, push-pull device **2680** may comprise similar structural features, or be configured similarly, as push-pull device **2180** (FIG. **21**).

When support structure **2600** is located in the transport/storage position, it may be operably disconnected from a base structure **2620** such that it may no longer be configured to provide a lifting function of base structure **2620** and/or of an associated rig that may be mounted to base structure **2620**.

FIG. **27** illustrates an example process **2700** associated with a mounting structure having a storable transport system. At operation **2710**, a base of the mounting structure may be supported on an operating surface, such as the ground, a mat, a pad, a platform, a barge, or other type of surface. The base may be connected to an elevated platform of the rig with one or more support beams. In some examples, at least one of the support beams may comprise a diagonal strut connecting the elevated platform to the base structure. By way of illustrative example only, an extraction of a petroleum-based resource may be performed at a first, or initial, location. In other examples, operations performed at the initial location may include drilling a hole, inserting a pipe, fracking, other types of operations, or any combination thereof.

At operation **2720**, the base of the mounting structure may be lifted off of the operating surface by a rig transport system to move the mounting structure to a destination and/or a second location, following the operation performed at the initial location. The mounting structure may be repositioned by moving the base from the initial location to the new location while a rig is supported by the mounting structure.

In some examples, mounting structure may be positioned by a first rig transport system positioned at the rear end of the mounting structure and a second rig transport system positioned at a front end of the mounting structure, opposite the rear end. The mounting structure may be positioned by raising the rear end of the mounting structure with the first rig transport system. Positioning the mounting structure may further comprise raising the front end of the mounting structure with the second rig transport system. In other examples, one or more transport systems may be located at different or additional locations with respect to the mounting structure.

At operation **2730**, the base of the mounting structure may be lowered by the rig transport system to the operating surface at the destination and/or at the second location, A second operation may be performed at the second location.

At operation **2740**, an elevated rig platform connected to the base by a plurality of support struts may be lowered. The elevated platform may be lowered while the base is in contact with the operating surface. At least some of the support struts may comprise a mounting connection that pivots to lower the rig platform toward the base. In some examples, the rig platform is lowered towards the base at the completion of an operation, such as where the mounting structure and/or rig are being prepared for storage and/or long distance transportation.

At operation **2750**, at least a portion of the rig transport system may be displaced by a connecting member in response to the rig platform being lowered. The portion of the rig transport system may be displaced by the connecting member while the base remains in contact with the operating surface. The connecting member may be configured to attach the portion of the rig transport system to one of the support struts that includes a pivoting mounting connection.

In some examples, at least a portion of the rig transport system may be displaced in order to provide a more compact mounting structure in the collapsed state. Additionally at least a portion of the rig transport system may be displaced in order to provide additional clearance between the rig transport system and one or more components attached to the rig platform being lowered to the base.

In some examples, the rig transport system may be configured to contact the operating surface at a load bearing position while lifting the mounting structure at operation **2720**. The connecting member may be configured to displace the portion of the rig transport system away from the load bearing position while the rig platform is being lowered at operation **2740**.

The base may comprise two walls connected by a substantially horizontal connecting structure or plate. One or both of the two walls may be configured to contact the operating surface when the mounting structure is not being lifted by the rig transport system. In some examples, the rig transport system fits between the two walls. Additionally, the rig transport system may comprise a transport device or walker that is configured to rotate with the confines of the two base walls. The portion of the rig transport system that is displaced may be located above the horizontal connecting structure. In some examples, the portion of the rig transport system may be laterally displaced along the horizontal connecting structure in response to the rig platform being lowered.

The base may extend substantially along an entire length of the mounting structure, and at least one of the rig transport systems may be connected to an end of the base. The portion of the rig transport system may be rotationally displaced about the end of the base in response to the rig platform being lowered.

At operation **2760**, the entire mounting structure and/or rig may be transported on a mobile transportation system such as one or more semi-trucks, rail cars, barges, other transportation vehicles, or any combination thereof. The mounting structure may be transported to a storage facility, and in some examples the mounting structure may be transported to a new operational site or destination which may be located many miles away from the present location. The mounting structure may be transported in the partially collapsed or completely collapsed position.

At operation **2770**, the support base of the mounting structure may be placed on the ground and/or on a support surface at the destination.

At operation **2780**, the rig platform may be raised to an elevated position on the mounting structure. The rig platform may be raised while the base is in contact with the operating surface. The mounting connections of the one or more support struts may pivot to raise the rig platform to the elevated position. In some examples, the rig platform may be raised to the elevated position prior to performing an operation at the destination.

At operation **2790**, at least a portion of the rig transport system may be repositioned by the connecting member in response to the rig platform being raised. The portion of the rig transport system may be repositioned and/or displaced by the connecting member while the base remains in contact with the operating surface. The connecting member may be configured to attach the portion of the rig transport system to one of the support struts that includes a pivoting mounting connection.

In some examples, the rig transport system may be configured to move the mounting structure between one or more drill sites at the destination with the rig platform in the raised position and with the portion of the rig transport system repositioned above a load bearing position of a corresponding transport device, such as a walker.

Some or all of the example structures discussed above with respect to FIGS. **14-27** may be configured to allow the rig platform to collapse down to the base during break-down or transportation of the rig to a drill site. In some examples, the examples may comprise connections that provide pivot points where they connect to one or more of the struts, braces, and/or legs.

A rig may be modified with one or more of the struts, legs, braces, connections, and/or structural features described with reference to FIGS. **14-27** to enable the placement of a draw-works on a rig and/or rig platform. The placement of the structural features, such as the struts, provides the ability to maintain a structural load path of the original rig design while drilling, after the rig has been modified.

Some examples have been described above, and in addition, some specific details are shown for purposes of illustrating the inventive principles. However, numerous other arrangements may be devised in accordance with the inventive principles of this patent disclosure. Further, well known processes have not been described in detail in order not to obscure the novel features. Thus, while examples are described in conjunction with the specific embodiments illustrated in the drawings, the examples are not limited to these embodiments or drawings.

The invention claimed is:

1. A load transporting apparatus comprising:

a support foot comprising a centerline;

a roller assembly operably coupled to the support foot;

a lift mechanism operably coupled to the roller assembly and configured to lift and lower the support foot relative to a load bearing frame;

a travel mechanism configured to displace the roller assembly relative to the support foot such that an orientation of the load bearing frame moves out of alignment relative to the centerline of the support foot; and

one or more biasing devices configured to elastically deform in response to the orientation of the load bearing frame moving out of alignment relative to the centerline of the support foot, wherein the resulting elastic deformation of the one or more biasing devices provides a biasing force that operates to realign the centerline of the support foot with the orientation of the load bearing frame.

2. The apparatus of claim **1**, wherein the one or more biasing devices comprise a torsion bar substantially aligned with the orientation of the load bearing frame.

3. The apparatus of claim **1**, further comprising one or more linking devices operably coupled to both the support foot and the one or more biasing devices.

4. The apparatus of claim **3**, wherein the one or more linking devices comprise a first linking device operably coupled to a first end of the support foot, and a second linking device operably coupled to a second end of the support foot opposite the first end of the support foot.

5. The apparatus of claim **4**, wherein the one or more biasing devices comprise a torsion bar operably coupled to both the first linking device and the second linking device.

6. The apparatus of claim **5**, wherein the torsion bar is configured to undergo a torqueing force in response to the orientation of the load bearing frame moving out of alignment relative to the centerline of the support foot.

7. The apparatus of claim **1**, wherein the one or more biasing devices are configured to elastically deform when the support foot is in a lowered position on a transport surface, and wherein the biasing force operates to realign the centerline of the support foot with the orientation of the load bearing frame when the support foot is raised from the transport surface.

8. The apparatus of claim **7**, wherein the lift mechanism is further configured to lift and lower the load bearing frame, wherein the one or more biasing devices are configured to elastically deform with the load bearing frame raised above the transport surface, and wherein the biasing force operates to realign the centerline of the support foot with the orientation of the load bearing frame after the load bearing frame is lowered to the transport surface.

9. An apparatus for transporting a load bearing frame, the apparatus comprising:

a support foot;

means for raising and lowing the support foot relative to a load bearing frame;

a roller assembly operably coupled to the means for raising and lowering, wherein the roller assembly is positioned above the support foot;

means for moving the load bearing frame relative to the support foot such that an angular displacement occurs between a centerline of the support foot and an orientation of the load bearing frame; and

biasing means configured to elastically deform in response to the angular displacement, wherein the resulting elastic deformation of the biasing means provides a biasing force that operates to realign the centerline of the support foot relative to the orientation of the load bearing frame.

10. The apparatus of claim **9**, wherein in response to raising the support foot, the biasing means is configured to automatically realign the centerline of the support foot relative to the orientation of the load bearing frame.

11. The apparatus of claim **9**, wherein the biasing means comprises one or more torsion bars.

12. The apparatus of claim **9**, wherein the load bearing frame is supported by a plurality of support feet, each of the support feet having separate biasing means for re-aligning the support feet with the orientation of the load bearing frame.

13. The apparatus of claim **9**, further comprising:

first means for linking operably coupled to both the biasing means and a first end of the support foot; and

second means for linking operably coupled to both the biasing means and a second end of the support foot.

14. The apparatus of claim **13**, wherein the biasing means comprises a torsion bar positioned between and coupled to both the first means for linking and the second means for linking.

15. The apparatus of claim **14**, wherein the torsion bar is configured to undergo a torqueing force in response to the angular displacement between the centerline of the support foot relative to the orientation of the load bearing frame.

16. A method comprising:

raising, with a lift mechanism, a load bearing frame relative to a transport surface, wherein the load bearing frame is supported above the transport surface by a support foot;

activating a travel mechanism operably coupled to the lift mechanism, wherein a roller assembly positioned above the support foot is configured to allow for movement of the load bearing frame over the transport surface in response to activating the travel mechanism;

angularly displacing an orientation of the load bearing frame relative to a centerline of the support foot as the load bearing frame moves over the transport surface, resulting in an elastic deformation of one or more biasing devices that creates a biasing force; and

realigning the centerline of the support foot relative to the orientation of the load bearing frame in response to an application of the biasing force.

17. The method of claim **16**, further comprising:

lowering the support foot to the transport surface prior to angularly displacing the orientation of the load bearing frame relative to the centerline of the support foot; and

raising the support foot from the transport surface after activating the travel mechanism, wherein the centerline of the support foot is automatically realigned relative to the orientation of the load bearing frame in response to raising the support foot.

18. The method of claim **16**, further comprising:

lowering the support foot to the transport surface, wherein the one or more biasing devices are configured to elastically deform with the support foot lowered to the transport surface and with the load bearing frame raised above the transport surface; and

lowering the load bearing frame to the transport surface, wherein the biasing force operates to realign the centerline of the support foot with the orientation of the load bearing frame after the load bearing frame is lowered to the transport surface.

19. The method of claim **16**, wherein the one or more biasing devices comprise a torsion bar, and wherein deflecting the one or more biasing devices comprises applying a torque force to the torsion bar.

20. The method of claim **19**, wherein realigning the centerline of the support foot comprises applying the torque force to the support foot via one or more linking devices operably coupled to both the torsion bar and the support foot.

21. The method of claim **20**, wherein the torsion bar is positioned between and operably coupled to both a first linking device and a second linking device of the one or more linking devices.

22. The method of claim **21**, wherein the first linking device is operably coupled to a first end of the support foot, and wherein the second linking device is operably coupled to a second end of the support foot opposite the first end.

23. A system for moving a load bearing frame over a transport surface, the system comprising:

a first support foot comprising a centerline;

a first roller assembly operably coupled to the first support foot and configured to move in a first direction;

a lift mechanism operably coupled to the roller assembly and configured to lift and lower the first support foot relative to the load bearing frame;

a travel mechanism operably coupled to the roller assembly;

a second support foot;

a second roller assembly operably coupled to the second support foot and configured to move in a second direction, wherein the second direction is different than the first direction, and wherein the simultaneous movement of the first roller assembly in the first direction and the second roller assembly in the second direction causes the load bearing frame to move in a spin steering mode; and

one or more biasing devices, wherein in response to a non-linear displacement of the first roller assembly relative to the first support foot during the spin steering mode, an orientation of the load bearing frame moves out of alignment relative to the centerline of the first support foot, resulting in an elastic deformation of the one or more biasing devices that creates a biasing force that operates to realign the centerline of the first support foot with the orientation of the load bearing frame.

24. The system of claim **23**, further comprising one or more linking devices operably coupled to both the first support foot and the one or more biasing devices.

25. The system of claim **24**, wherein the one or more linking devices comprise a first linking device operably coupled to a first end of the first support foot, and a second linking device operably coupled to a second end of the first support foot opposite the first end.

26. The system of claim **25**, wherein the one or more biasing devices comprise a torsion bar operably coupled to both the first linking device and the second linking device.

27. The system of claim **23**, wherein in response to a non-linear displacement of the second roller assembly relative to the second support foot during the spin steering mode, the orientation of the load bearing frame moves out of alignment relative to a centerline of the second support foot, and wherein the one or more biasing devices of the second support foot creates a biasing force that operates to realign the centerline of the second support foot with the orientation of the load bearing frame.

28. The system of claim **27**, wherein the one or more biasing devices are configured to elastically deform with both the first support foot and the second support foot lowered to the transport surface, and wherein the one or more biasing devices are configured to realign the centerlines of the first support foot and the second support foot with the orientation of the load bearing frame when both the first support foot and the second support foot are raised from the transport surface.

29. The system of claim **28**, wherein the lift mechanism is further configured to lift and lower the load bearing frame, wherein the one or more biasing devices are configured to elastically deform when the load bearing frame is in a raised position above the transport surface, and wherein the one or more biasing devices are configured to realign the centerlines of the first support foot and the second support foot with the orientation of the load bearing frame after the load bearing frame is lowered to the transport surface.

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